Railway Mechanical Engineer

October 1947

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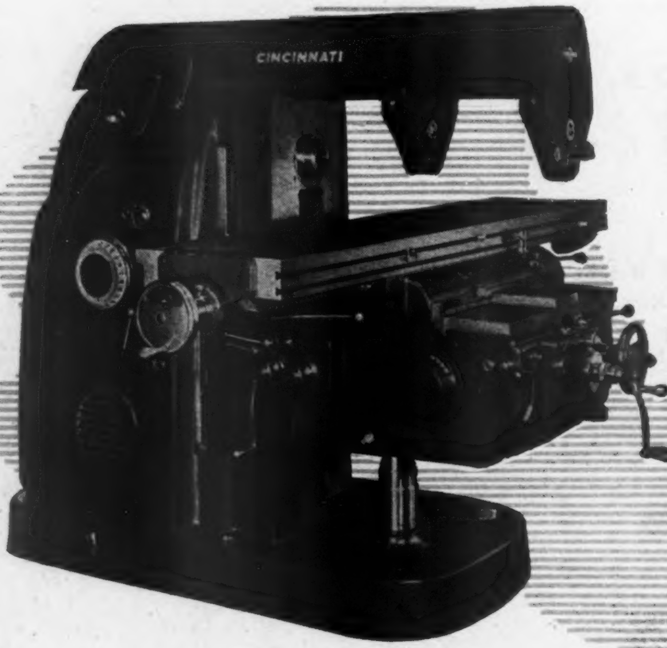

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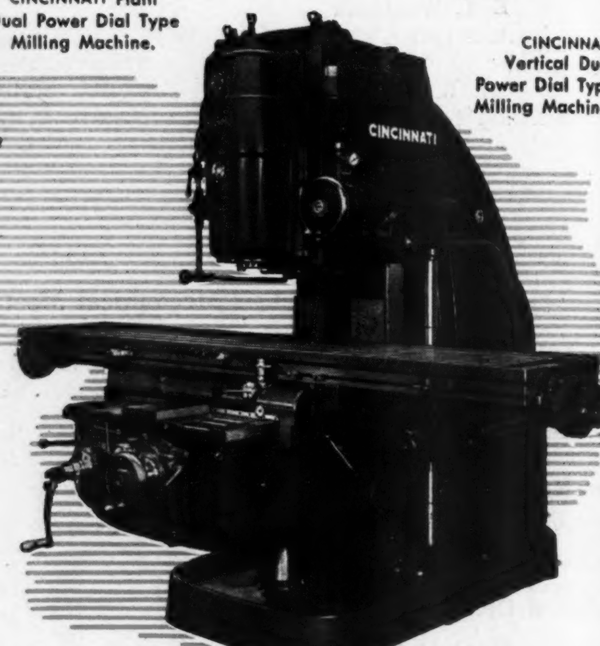

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1947 Mechanical Meetings

With a total attendance of over 2,000 railroad men at the Coordinated Mechanical Association meeting in Chicago, September 15 to 18, inclusive; with all five of the associations offering more constructive programs of individual addresses and committee reports than any they have presented before; and in view of the notably comprehensive exhibition of railway mechanical equipment, devices and materials which surpassed in educational value any such exhibit previously held in the Middle West, it is difficult to understand how any adverse criticism of the convention could be justified. Great care was exercised in advance to avoid duplication of subjects presented before the respective associations and certain subjects such as safety and personnel training of general interest to all departments were ably covered in joint sessions.

In spite of the care with which the various meeting programs were coordinated, however, the objection has been advanced by a number of ranking railway officers in attendance at the Chicago meeting that it was in reality a five-ring circus and that no one pair of eyes or ears could cover the entire proceedings, or listen to all the reports in which one man might conceivably be interested. Take, for example, railway mechanical officers from the rank of master mechanic and up, who in many instances are responsible for both locomotive and car details, also road performance, fuel economy, air brake operation, etc., how will they decide which association meeting to attend? If they sit in with the fuel and traveling engineers they may miss a subject of keen interest to them which is scheduled for discussion by one of the other groups, such as the locomotive men, car men, air brake supervisors, or boiler makers?

Another problem associated with the holding of joint mechanical association meetings during the same week in Chicago is the fact that, if all the higher general officers and particularly local supervisors attend these meetings who really should be present and participate in them, the number of supervisors left on the job to run their respective railroads would be pretty largely depleted. The answer to this particular problem, while not 100 per cent satisfactory, is, of course, for individual railroads to send as many supervisors as can be spared from each department to the convention one year and a different group the next.

It is not the purpose of this editorial to suggest any change in the fundamental plan of Coordinated Mechanical Association annual meetings, which has the general approval of the A. A. R. Mechanical Division for a number of entirely valid reasons. In the first place, holding the annual meetings of all five associations at the same time and place, instead of spreading them all over the landscape, saves travel time and expense for both railway and railway supply men. Then there is the important consideration that, without the large attendance of railway supervisors assured by the coordinated meetings, it would be impossible to present anything like the representative exhibition of car and locomotive devices and materials which was held at Chicago during the third week of September.

Every effort was made by the executive committees of the several mechanical associations to plan the program in such a way that the holding of sessions on the same subjects concurrently would be eliminated but, as it worked out, it was not possible to achieve the ideal coordinated program. The answer seems to be for the general officers of the railroads to recognize and appreciate that these meetings are a source of inestimable value as a means of educating supervisory staff members and that they should select from the advance programs the reports and addresses in which they are vitally interested, then make sure that sufficient men from each road are assigned to attend the meetings so that every important subject is covered by a staff member who will be in position to return to his job and disseminate the information to his fellow workers.

The fact that members of the editorial staff of the *Railway Mechanical Engineer* were available so that each of the five association meetings were covered by a different editor makes it possible for this publication to present in this, and subsequent, issues most of the reports and discussions presented at the Chicago convention. This year the caliber of the technical material presented was of the highest order and the reports and discussions are of such value that they merit the keenest analysis by railway men, whether they were privileged to be at Chicago or were numbered among that larger group who will have to judge the value by reading about it.

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Joint Sessions of the Coordinated Mechanical Associations

J. W. Barriger

Super-power for the railroads of the future discussed opening day and later session took up the problems of personnel training and the organization of safety work

During the four-day meeting of the Coordinated Mechanical Associations at the Hotel Sherman, Chicago, two joint sessions were held, one on Monday, September 15, which was in the nature of an opening session and the other on the afternoon of Wednesday, September 17. On Monday, S. O. Rentschler, president of the Locomotive Maintenance Officers' Association and general manager of the Elgin, Joliet and Eastern, introduced J. W. Barriger, president of the Monon, as the principal speaker. Mr. Barriger discussed railway motive power in its relation to future operation. Excerpts from his address appear below.

The general theme of the joint session on Wednesday, September 17 was directed to the problems of personnel and safety. As in previous years, one or more of the associations have contributed to this session by including in their programs, reports or addresses on such general subjects as personnel that are of interest to the members of all the Associations. This year three such reports were included in the joint session program, one on the training of personnel, one on the organization of safety work and one on the specific subject of the training of engine crews for Diesel-electric locomotives. The first two of these reports were part of the program of the Locomotive Maintenance Officers' Association and the latter was a part of the program of the Railway Fuel and Traveling Engineers' Association. These reports appear here in abstract.

Super-Power for Super-Railroads

From the outset, railway operating economies have primarily been the end product of moving heavier trains faster and the possibilities for achieving further economies are unlimited

By J. W. Barriger

President, Chicago, Indianapolis & Louisville

Tractive force is the basis of railway service and hence is the source of railway revenue. It is therefore the product which railways manufacture. The factor establishes locomotive operation as the fundamental element in rail transportation. It follows that the nature and detail of a railway plant are determined by the limitations and requirements and opportunities of the locomotive

which use it. Improvements in standards of service and efficiency stem largely from management's unrelenting demands for continued development of the locomotive to haul longer trains faster and at lower unit costs. . . .

The development of the locomotive is the gage of railroad progress, but the reverse side of the coin is the fact that any inadequacies in service or excesses in unit costs suggest deficiencies in motive power standards of efficiency or utilization. The same forces which spur progress in steam locomotive design and construction also produce attempts to short circuit it and seek completely new sources of motive power. The revolutionary progress of the electrical industry in the early decades of this century stimulated immediate interest in the possibilities which this type of energy might possess to release the railroads from some of the familiar handicaps of the steam locomotive.

Electric Traction

Electric traction permits the highest possible standards of locomotive operation. The barrier to its immediate universal use was the high capital cost which restricted installation of the originally required electric power distribution system to super density lines, or ones with tunnel or terminal or suburban passenger problems, and these entail but a tiny fraction of the railway network. Until the progress of science permits electric power to be transmitted from central stations without wires and cables, the only means of providing electric railway traction without costly overhead or third-rail transmission systems is to have the source of electric power made an integral part of the electric locomotive, just as the boiler is of the steam type. This not only dispenses with the need of electric power distributing facilities but makes the electric locomotive as flexible as its steam counterpart. . . .

The switcher provided the Diesel engine with its first introduction to freight service and the rail car to passenger work. Most switching requires low horsepower but high tractive force and ability to accelerate rapidly at low speeds. The Diesel engine, with the direct-current generator and motor, have ideal characteristics to meet these requirements. Moreover many switching assignments are "around the clock" on a 24-hr. continuous basis. Steam switchers usually lose the equivalent of one shift of the three for servicing, and are forced to take time out during the other two for refilling the water tank. Diesel switchers can run continually with only about one 8-hr. shift lost per month for routine servicing and repairs. An average of 7 gal. of fuel oil will be consumed per hour by a 1,000-hp switcher, in ordinary work. This totals 168 gal. per day. Several days' supply is carried in the fuel storage tanks under the locomotive and these can be filled, if necessary, from tank trucks sent out from the enginehouse to meet the switcher on the job. This high availability, and low fuel consumption in comparison with steam, due to elimination of standby losses and reduced servicing and repair costs, give the Diesel a great advantage in ordinary terminal and yard work. One Diesel can perform the work of two or more steam switchers and unit costs per hour represent a substantial saving over that possible with steam service. For a time there was the additional benefit resulting from one-man operation of the Diesel which needs no helper, but the railroads later agreed to assign a second man on switchers weighing 90,000 lb. or more, hence the popularity of the 44-ton unit for light work.

The Diesel started in passenger service propelling small rail motor cars and provided surplus power sufficient to haul no more than one or, at the most, two light trailers. Trains of this character were very useful on light traffic branch lines. In 1934-35 the Burlington and the Union Pacific designed trains which were planned to utilize the highest available capacity Diesel engine suitable for transportation purposes to propel trains of specially-designed cars built of high-tensile alloy metals. The Diesel engines were placed in a power car which became an integral part of the train. These new trains were sensationally successful and within a very few years created a widespread demand for service of that character.

The resultant development of Diesel motive power led to the development Diesel locomotives which were no longer a mere power-car portion of an articulated train, but were completely flexible units that could be used wherever desired. The rapid development of this type of power soon permitted locomotives of 1,800 hp. capacity to be built which utilized two 900-hp. engines in a single cab. Two or more of these units could be coupled for multiple operation controlled from the forward one.

It is significant to observe that the first Diesel-electric road locomotive was Canadian National's No. 9000, built in 1928. It comprised two cabs each equipped with 1,330-hp. Beardmore Diesels which gave 2,660 hp. for the complete locomotive. The progenitor of C.N. 9000, which is "the daddy" of all road Diesels, was the late Sir Henry Thornton, and Diesel motive power on the National during his regime could well be pointed to as proof of the general outline of the foregoing remarks about the early history of this type of locomotive.

Diesel locomotive development has followed that of the steam locomotive and can be gaged by horsepower output. As fast as it progressed to higher ranges, new and more important assignments opened up for it. Diesel motive power is now available in such a variety of types and capacities that a Diesel locomotive can now be secured which will perform most assignments better and more economically than steam power.

Further Improvement Sure

The spectacular progress of Diesel locomotive development and its economic superiority over the reciprocating steam locomotive should not however make anyone indifferent or complaisant towards those of its characteristics which are not wholly satisfactory or are under-developed. The great manufacturers of these machines are striving for improvement of their products and are aided in their efforts by the experience and cooperation of the railroads. It is reasonable to expect that the rate of progress of Diesel locomotive development over the next decade will equal or surpass that of the last one.

At the present time 6,000-hp. Diesel locomotives are approximately 200 ft. long and require the support of 16 axles, all motor driven, if the consist is four 1,500-hp. cabs, or 18 axles, of which 12 are motorized and 6 idlers, if the pattern is three 2,000-hp. cabs. I venture the opinion that ten years hence, or possibly much sooner, Diesel locomotives of increased power output will not exceed 125 ft. in length and will consist of a single articulated unit.

The present small-diameter driving wheels, directly geared to a single traction motor mounted in swivel trucks, are more akin to car than to locomotive design. In a Diesel locomotive of the character suggested, two large motors will turn each set of driving wheels and their torque will be transmitted through the quill form of spring-cushioned drive to the spokes of large-diameter wheels, journaled in the locomotive frame, thereby following the present practice of all electric locomotives.

Only 400 Hp. Per Axle

Steam locomotives now transmit as high as 1,000-1,250 hp. per axle. Diesel locomotives do not transmit more than 400 hp. per axle. While recognizing that this difference underlies the high initial starting tractive force of the Diesel, this in itself becomes of no practical value when it exceeds the capacity of the drawbars of the cars in the train to transmit it. Diesels have such an inherently large starting tractive force that some of it can be sacrificed if need be to reduce locomotive length and remove all time limitation on slow-speed operation with high drawbar pull. As the length of Diesels is compressed and their overall weight per horsepower reduced, the power transmission per axle will approximate that of steam locomotives.

Every four years the railroads spend the equivalent of their original investment in steam locomotives in repairs to them and the gross annual expenses of owning and operating steam locomotives represent about 75 per cent of the original cost of these machines. It is obvious from such basic considerations that an important capital investment is justified to obtain the economies that follow Dieselization.

Steam engines were first used to pump water out of coal mines, and in both England and America railroads were built to haul coal before any were used for the commercial transportation of freight and passengers. When to these historic factors is added the development of the coal industry into the principal traffic base of the railways of the United States, it is clearly apparent that recent advances in locomotive technology placing new locomotives on liquid instead of solid fuels would develop some important strains and dislocations except for economic events which produced more than offsetting demands for coal.

However, it is important for many reasons for railways to return to coal for fuel. It now seems unlikely that any railroads except those so closely linked to the coal industry as the

Norfolk & Western, Chesapeake Ohio, Virginian, and Clinchfield will ever again order any substantial numbers of reciprocating steam locomotives. I believe that the coal-burning gas-turbine locomotive will be successfully developed as a prime mover to turn the generator of self-contained electric locomotives of near future years.

Coal Hydrogenation Suggested

It may be, however, that a quicker recovery of the position of coal as locomotive fuel can be effected by hydrogenation of it into a Diesel oil. Great progress has been made in this direction and now that the problem of providing sufficient petroleum for the nation's liquid fuel requirements is becoming acute, railroads may soon be able to have their Diesel locomotives and burn a liquid fuel in them that has been produced from coal instead of petroleum.

One must never forget that when Rudolph Diesel made his great invention, he was really searching for a device to burn coal in an internal-combustion engine. He expected to use liquid fuel in its elementary stages of development, but intended to perfect the device for injection of solid fuel in powdered form. His untimely death and subsequent developments in the petroleum industry removed the pressure and incentives to achieve Diesel's full ambition—but the time seems ripe to do it soon. Certainly the problems of solid-fuel injection and disposal of the waste products should not be beyond the possibility of solution by the resourcefulness and talent and scientific ingenuity of engineers.

From the very outset, railway operating economies have primarily been the end product of moving heavier trains faster. This resulted from massing greater and greater aggregate quantities of horsepower on each train. That has been the route of railway progress in the past. The achievements in locomotive development from 1829 through this present day do not exhaust the possibilities of the improvement of the "iron horse" but instead lay a broad foundation for its assuredly rapid and continued improvement.

Super-power and super-railroads will provide the formula for permanent success!

Training Understudies and Promoting Supervisors

There is no good reason why there should not be a definite program for selecting and training understudies for supervisory jobs except that it requires effort and costs money

There seems to be no good reason why the locomotive department of American Railroads should not have a definite program for selecting and training understudies and promoting supervisors, other than it requires effort and slight additional expense. While any kind of worthwhile training usually costs money, it is also true that any money spent wisely in a practical and comprehensive program can be justified and will pay big dividends. As far as effort is concerned, nothing worth while is accomplished without it. Failure to inaugurate a practical program because of the slight additional expense that may be involved more often than not is false economy.

H. J. Schulthess,
Chairman

Training Understudies

The purpose of, and necessity for, selecting and training understudies should be to build up continually a reserve of well-qualified supervisors for the future and to raise continually the standard of supervision. These objectives cannot be attained by hit-or-miss methods but only through a well-planned and executed program.

Whose responsibility is it to see that a well-planned program is placed in operation and continually followed up? First, it should be the responsibility of the head of the Locomotive Department in planning an effective program, in seeing that it is placed in operation, and in continually following it up. Second, each supervisor should be made responsible for selecting and training an understudy, providing of course that he has a suitable man under his jurisdiction to train.

Each supervisor should know more intimately than anyone else the men under his immediate supervision. It naturally follows that he should therefore be in a better position than anyone else to select the best possible candidate for an understudy, if he has been properly instructed in the mechanics of selecting one.

It should also be the responsibility of the head of the locomotive department to see that all supervisors under his jurisdiction are furnished with sufficient information to enable them to properly select understudies. It is recommended that such information include a rating chart to aid a supervisor in making a selection. A sample rating chart which may be used in selecting an understudy who has not yet been promoted to a supervisory position is shown as Fig. 1. By filling out this rating chart on two or more candidates, it will enable a supervisor to compare one with another and to determine which of the candidates ranks highest in connection with the leadership characteristics listed.

Understudies may be divided into two categories—those who have not yet been promoted to supervisory positions, and those presently in supervisory positions who may be considered for understudies to higher supervisory positions. The rating chart shown as Fig. 2 should be used with the rating chart shown as Fig. 1 when selecting as an understudy a man who is already a supervisor.

Before making a final selection of an understudy, it is important that a supervisor seek the advice and approval of his superior, and others concerned, regarding the man he proposes to select.

After an understudy has been selected, the supervisor should do everything he can to train him for the position he is understudying. He should give him the benefit of his knowledge and experience. He should teach him sources of information. He should counsel and advise him. He should encourage him to read and study, from whatever source, the things that will be helpful to him. If the understudy has certain undesirable characteristics that may be a handicap to him or characteristics which the supervisor feels can be improved, he should discuss them with the understudy in a friendly and tactful manner. No greater compliment may be paid a supervisor in his work than to have said of him, "He is a trainer of men."

An understudy should be trained so that he will have a thorough knowledge of the methods and procedure of the work coming under the jurisdiction of the position he is understudying. He should become thoroughly acquainted with controlling labor agreements and be instructed on the interpretations thereof. He should be taught the fundamentals of cost accounting and the procedures required to be followed in order that the distributions reach the Accounting Department in the best manner possible. He should by all means be safety-minded and have a good safety record. He should be courteous to subordinates as well as to superiors, and he should also be friendly at least to a degree that will obtain cooperation and understanding from others.

Any supervisor who strives to be a real teacher and trainer will find that he is also contributing much to his own further development. It has happened that a supervisor has lost out on a further promotion because he did not have an understudy trained to take his place.

The responsibility rests with the head of the locomotive department in further training all supervisors in his department. This in turn indirectly but vitally affects the training of understudies, particularly those who have not yet been promoted to supervisory positions. No supervisor can teach an understudy about things

Rating chart used by a supervisor in selecting an understudy who has not been promoted to a supervisory position.

	Ratings*				
Loyalty	( )	( )	( )	( )	( )
Dependability	( )	( )	( )	( )	( )
Proper attitude	( )	( )	( )	( )	( )
Adaptability	( )	( )	( )	( )	( )
Ambition (the will to improve)	( )	( )	( )	( )	( )
Safety-mindedness	( )	( )	( )	( )	( )
Good health habits	( )	( )	( )	( )	( )
Friendliness	( )	( )	( )	( )	( )
Self-confidence	( )	( )	( )	( )	( )
Reaction to criticism	( )	( )	( )	( )	( )
Neatness	( )	( )	( )	( )	( )
Cheerfulness	( )	( )	( )	( )	( )
Unselfishness	( )	( )	( )	( )	( )
Industriousness	( )	( )	( )	( )	( )
Following instructions	( )	( )	( )	( )	( )
Making suggestions	( )	( )	( )	( )	( )
Control of temper	( )	( )	( )	( )	( )
Sense of humor	( )	( )	( )	( )	( )
Courtesy	( )	( )	( )	( )	( )
Initiative	( )	( )	( )	( )	( )
Ability to plan and organize work	( )	( )	( )	( )	( )
Cooperation	( )	( )	( )	( )	( )
Enthusiasm	( )	( )	( )	( )	( )

* RATING KEY: A—Excellent; B—Above average; C—Average; D—Below average; E—Poor. Five rating columns are provided so that from one to five men may be rated on this sheet and for ease in making comparisons. A code symbol may be placed at the top of each rating column to identify the man or men rated. This chart should be used together with the one shown as Fig. 2 when a man or men being considered for selection are already supervisors.

Fig. 1

beyond his own knowledge. Along this line, the head of the locomotive department can be very helpful to supervisors under his jurisdiction by keeping them informed in connection with current developments in his department, etc. This can be accomplished, at least in part, by a monthly or semimonthly letter from the head of the locomotive department to all supervisors. These letters should be short—generally, not over one or two pages. They would also afford an opportunity to pass on one or more pertinent thoughts in each letter, informative, educational, or instructive, to all supervisors at the same time. Such letters would be of help to supervisors in several ways. They would help to promote a closer relationship between the head of the department and all supervisors. They would stimulate thinking. They would be of help in bringing about still better coordination and cooperation, and in supervisors working more closely as a team. They would help each supervisor to realize more fully that he is a part of management. Every supervisor *is* management to the employes under his jurisdiction, and the more he knows about what is going on and the technique of supervising people, the better job he can do in representing management to the employes he supervises.

Many practical and effective programs in other industries do not have the same application to a railroad. For example, a manufacturing plant having several thousand employes at one place, can call their entire supervisory staff together at an hour's notice to discuss some new plan or policy. This has never been practical on the average railroad because supervisors may be scattered over several states.

Rating chart used in selecting an understudy who is already a supervisor.

Ability to handle men	( )	( )	( )	( )	( )
Ability to train and develop subordinates	( )	( )	( )	( )	( )
Safety record of employes supervised	( )	( )	( )	( )	( )
Housekeeping performance	( )	( )	( )	( )	( )
Attitude toward suggestions from subordinates	( )	( )	( )	( )	( )
Knowledge of work supervised	( )	( )	( )	( )	( )
Ability to make decisions	( )	( )	( )	( )	( )
Ability to write instructions clearly and concisely	( )	( )	( )	( )	( )
Ability to conduct meetings and conferences	( )	( )	( )	( )	( )
Willingness to assume new responsibilities	( )	( )	( )	( )	( )
Knowledge of labor union agreements	( )	( )	( )	( )	( )
Ability to conduct and report on investigations	( )	( )	( )	( )	( )

RATING KEY: A—Excellent; B—Above average; C—Average; D—Below average; E—Poor. Five rating columns are provided so that from one to five men may be rated on this sheet and for ease in making comparisons. A code symbol may be placed at the top of each rating column to identify the man or men rated.

Fig. 2

The railroads have been somewhat criticized in the past for not giving supervisors more information about the operations of the industry, and particularly their own railroad and the department in which they are employed. Probably the most important reason why more of this has not been done is because of the lack of a practical method of doing it.

The mechanics of sending out monthly or semimonthly letters are comparatively simple. They can be sent out by railroad business mail, and they should of course be marked "Personal." An addressograph plate can be made for each supervisor, and envelopes addressed at one time for several mailings. The addressograph plates and addressed envelopes should be kept in alphabetical order for ease iin making changes occasioned by transfer, change in title, resignation, death, retirement, etc. The letters may be typewritten and signed on the letterhead of the head of the locomotive department, and reproduced by the multilith or some similar process which is inexpensive and preferable to mimeographing or hectographing. It is recommended that the letters be punched for standard three-ring binder so that supervisors may keep them for future ready reference. If extra copies of each letter are printed, a complete set of the letters can be furnished whenever a new supervisor is appointed.

The power of suggestion is a strong influence in the lives of all of us. These letters, if properly compiled, can wield a strong influence among supervisors, and in turn among understudies who have not as yet been promoted to supervisory position.

Promoting Supervisors

In promoting men to appointive supervisory positions, and from one appointive supervisory position to a higher appointive supervisory position, your committee offers the following recommendations: To raise continually the standard of supervision, there should always be one pre-trained man in reserve for each level of appointive supervision to protect future vacancies as they occur. The men in this reserve group should be the best from each level of supervision, and the best from below the first level of supervision.

It is felt that the best results in pre-training men for this reserve group are obtained by considering the best candidates on a system or regional basis rather than only on a division or local basis. It is recommended that in considering the best candidates on a system basis, a committee be set up on each master mechanic's division to recommend candidates to a general committee. (On railroads having shop superintendents, a separate committee would be set up for each, and the shop superintendent would be the committee chairman. To avoid repetition and for purposes of this report, only the master mechanics' division com-

mittees are hereafter mentioned as the shop superintendents' committees would function in exactly the same manner.)

The master mechanic's division committee would consist of the master mechanic, his assistant if he has one, and one or more general foremen in the locomotive department, and anyone else the master mechanic wishes to appoint. The master mechanic would be the chairman. The general committee would consist of the head of the locomotive department of the system on the average railroad (and of the region on large railroads), his assistant or assistants, and whatever staff men he may select to serve on the committee. The system or regional head of the locomotive department would be the chairman of the general committee.

These committees could function as follows: In selecting a candidate to fill a future appointive supervisory position, each master mechanic's division committee would be asked to submit to the general committee the names of from one to three candidates who, in the opinion of each division committee, are the best candidates for the position. When the names of more than one man are submitted by a division committee, they would indicate their first, second, or third choice, as the case may be. Each member of the committee would fill out the rating chart or charts incorporated in this report as Exhibits "C" and "D" on each man recommended, without consulting each other and without

Rating chart used by each member of Master Mechanic's Division Committee, or Shop Superintendent's Committee, in rating a candidate who is to be recommended to the General Committee.

Loyalty	( )		
Dependability	( )		
Proper attitude	( )	Date	
Adaptability	( )		
Ambition (the will to improve)	( )	....	
Safety-mindedness	( )	(Name of man rated)	
Good health habits	( )		
Friendliness	( )	....	
Self-confidence	( )	(Location)	
Reaction to criticism	( )		
Neatness	( )	....	
Cheerfulness	( )	(Department)	
Unselfishness	( )		
Industriousness	( )	....	
Following instructions	( )	(Present position)	
Making suggestions	( )		
Control of temper	( )	....	
Sense of humor	( )	(Signature of rater)	
Courtesy	( )		
Initiative	( )	....	
Ability to plan and organize work	( )	(Position of rater)	
Cooperation	( )		
Enthusiasm	( )		

RATING KEY: A—Excellent; B—Above average; C—Average; D—Below average; E—Poor. This rating chart to be used alone when the man recommended has not been promoted to a supervisory position. This chart should be used together with the one shown as Fig. 4 when the man recommended is already a supervisor.

Fig. 3

making any comparisons. These rating charts would be held strictly confidential. No copies would be made or retained by the master mechanic's committee. No candidate should be told by the division committee that he has been recommended.

The name or names of the candidates together with their rating charts and personal record files would then be submitted by each of the division committees to the general committee who would carefully consider the various candidates who have been recommended, after which a final selection would be made.

The head of the locomotive department on the system or region, as the case may be, would call in the man selected for an interview. It should be determined in this interview whether or not the man selected is interested in being promoted to the level of supervision for which he is being considered. The head of the department may not know where the next vacancy will occur in the kind or class of supervisory position for which this man has been selected. It may be that the vacancy will occur at some point other than where the man is presently located. The man should thoroughly understand this and be willing to move to another point if necessary. The interview should also determine whether or not the man is willing to further prepare himself and go through any additional necessary training if, in the judgment of the head of the locomotive department, additional training is needed before the man is actually promoted.

In some cases additional training may be needed. For example, a man who has been selected to fill a future vacancy as general foreman may need some additional training other than what he has already had. If so, the head of the locomotive department could request authority, if necessary, to put this man through a special training program in line with his particular needs and requirements. The head of the locomotive department may wish to have the man spend some time with some of his staff assistants, with the mechanical engineer, in the accounting department to become familiar with the distribution of charges, etc. If the man is not any too familiar with the railroad, it would be desirable to have him visit some of the points other than where he has worked. If he is not familiar with conducting and reporting investigations, it would be desirable to see that he is given the necessary instructions along this line and have him sit in on a few investigations. In some cases it may be desirable to have him visit with one or more of the superintendents, with a chief dispatcher, etc., and also to send him to one or more conventions to broaden his over-all viewpoint in connection with the work of which he may some day be in charge. Such additional training would not necessarily be the same for each man selected to fill future vacancies in the different levels of supervision. Whatever additional training may be necessary in any individual case, can always be determined.

It is not the thought of the general committee to select and have in reserve more than one pre-trained man for each class or category of appointive supervision. For example, it would not be desirable or good policy to select five or six men at one time and pre-train them to fill future vacancies that may occur in the position of general foreman. Such practice would tend to build up false hopes in the hearts of men selected who might not be promoted, as it may be a year or years before the first vacancy occurs and in some cases it could be 15 or more years before the fifth or sixth vacancy occurs. By that time the remaining men first selected may be too old, and there probably would be new and more promising candidates available.

The program recommended for promoting men to appointive supervisory positions can function effectively and efficiently. When candidates are carefully selected on a competitive basis and are pre-trained to fill future appointive supervisory positions *before* vacancies occur, much better results are always obtained compared with selecting men to fill positions *after* vacancies occur.

In conclusion, the committee believes that if there is one pre-trained man in reserve at all times for each category of appointive supervision, the objectives of raising continually the standard of supervision, and of having well-qualified supervisors to fill all future needs, can be attained.

The report was signed by H. J. Schulthess (chairman), chief of personnel Denver and Rio Grande Western, Denver, Colo.; K. Berg, superintendent motive power, Pittsburgh & Lake Erie Railroad; C. F. Brooks, mechanical engineer, Erie; W. V. Hinerman, assistant to superintendent motive power, Chesapeake & Ohio; G. A. Howard, general supervisor of apprentice train-

Rating chart used by each member of Master Mechanic's Division Committee, or Shop Superintendent's Committee, in rating a candidate who is to be recommended to the General Committee.

Ability to handle men	( )	
Ability to train and develop subordinates	( )	Date ....
Safety record of employes supervised	( )	....
Housekeeping performance	( )	(Name of man rated)
Attitude toward suggestions from subordinates	( )	....
Knowledge of work supervised ..	( )	(Location)
Ability to make decisions	( )	....
Ability to write instructions clearly and concisely	( )	(Department)
Ability to conduct meetings and conferences	( )	....
Willingness to assume new responsibilities	( )	(Present position)
Knowledge of labor union agreements	( )	....
Ability to conduct and report on investigations	( )	(Signature of rater)
		....
		(Position of rater)

RATING KEY: A—Excellent; B—Above average; C—Average; D—Below average; E—Poor. This rating chart should be used together with the one shown as Fig. 3 when the man recommended is already a supervisor.

Fig. 4

ing, Canadian National; W. H. Sagstetter, chief mechanical officer, Denver & Rio Grande Western, and Roy V. Wright, editor, *Railway Mechanical Engineer*.

Discussion

In response to a question by W. H. Roberts, Chairman Schulthess said that ratings as to the fitness of individuals for supervisory appointments can not be weighted, but a comparison of the ratings will usually indicate without difficulty the man who is best fitted for each particular job. The chairman stated that his proposed method of training and rating understudies avoids the highly unsatisfactory process of selecting candidates *after* rather than *before* vacancies occur.

W. H. Sagstetter, formerly chief mechanical officer, Denver & Rio Grande Western, said that the system suggested will cut out personalities and enable the quality of supervision to be improved on a system-wide basis.

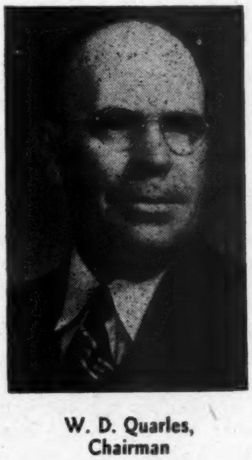
J. D. Loftis, chief of motive power and equipment, Atlantic Coast Line, said that the report is a step in the right direction; that supervisors are the key to good railroad management and even at the lowest level must be men of superior attainments. For example, they must have some of the attributes of a lawyer, a tool engineer, production expert and personnel student. He said that the Atlantic Coast Line and doubtless many other roads have been working from hand to mouth with respect to supervision for some time. He stressed the importance of railway officers and supervisors selling their individual railroads and management policies to the men who work for them.

In closing the report, Mr. Schulthess said that, unfortunately, the final results of personnel training programs are not convertible into dollars and cents. This increases the difficulty of securing adequate appropriations.

Training the Diesel Locomotive Crew

Proposed suggestions for training Diesel-electric crews describe classroom lectures, road instruction by riders, question-and-answer books, and engine-failure bulletins

With the advent of heavy high-speed trains powered with Diesel-electric locomotives, the requirement of a well arranged educational program to fit in with the entirely new type of locomotive is essential. While the Diesel-electric locomotive contains mechanical principles employed in industry for many years, railroaders, as a rule, know very little about other industries, and all had to be educated to maintain and operate the new type of locomotive. Men in engine service who had operated steam



W. D. Quarles,
Chairman

locomotives for years necessarily had to be taught a new technique.

The education of enginemen in the operation of a new-type locomotive is the responsibility of the railroad, and the road foremen of engines and electrical supervisors are the key men in the program of education. This was realized in advance by many Diesel users. Prior to the delivery of the first Diesel locomotive to the Atlantic Coast Line, shop foremen, road foremen of engines and electrical supervisors attended the manufacturer's Diesel classes. Many observed Diesel operation on other railroads, and this was the foundation on which the organization was built to train and educate engine crews. As in steam-locomotive operation, the men were found to be eager for enlightenment. When the first Diesel locomotive was received, it was sent over the system with stops of a day or two at each division terminal where enginemen and firemen were afforded an opportunity of inspecting the equipment. This acquainted them in a general way with this type of power.

Road and Classroom Instruction

When the locomotive was placed in service it was necessary for the road foreman of engines to ride the locomotive and to impart instructions to the engine crews. In this he was assisted by the electrical supervisors, and as soon as possible, education in a general way was started. This was accomplished by means of an instruction car with a full-time instructor. The lectures given covered the fuel-oil, the lubricating-oil and the cooling system of the Diesel engines, as well as the makeup of the engine. The lectures were followed by instructions in elementary electricity, the various control devices, traction motors, main generators and the troubles usually experienced in the operation of and train handling with a Diesel-electric locomotive, including throttle manipulation. Visual education with actual parts, stereoptican views, talking movies, printed diagrams, cut-aways and blow-ups were used. Supplementing instructions from the school car, road foremen and electrical supervisors conducted classes on the locomotive and in class rooms at various terminals. Some of the more energetic road foremen and supervisors built plywood panels upon which complete control circuits were wired, with lights to represent the various fields and power contactors. Upon failure of a contact or interlock, the lights on the particular circuit go out. The introduction of this feature is helpful in educating engine crews to make sequence checks and to learn the electrical circuits. Enginemen, as a rule fear trouble with the control circuit more than any other phase of Diesel-electric operation, and as a matter of fact, more trouble has been experienced with these circuits than with any other phase of operation. The trouble includes failures to transfer the motor arrangement because of a defective interlock, high-resistance electrical connections, blown fuses and stuck ground relays or starting contactors.

Other Sources of Information

A book of questions and answers published by the railroad can be furnished the engine crew and will be of inestimable value. The questions and answers should cover the engine control circuit, electrical transmission, steam generators, air brakes and miscellaneous information peculiar to the operating conditions on the particular railroad. These books should be small and easily carried in the pocket where enginemen can refer to them when on the road and away from assistance. Engine failures and near failures have been prevented by engine crews having handy information for ready reference.

Another method of education is to furnish the enginemen and other interested operating parties with information covering poor performances, abuse or failures. It should be understood that

in so doing the sole purpose is education and to add to the engineman's knowledge of the operation, and not criticism of crews. The information is system-wide as all failures are analyzed in the chief of motive power's office. The data and engine crew names are omitted. The information contains the point where the failure occurred, whether tonnage was reduced or the locomotive given up, the cause of the failure and the action taken by the crew, and the remedy or preventative measures to be taken in future occurrences. This type of instructions is of vital interest to engine crews for what has happened could very well have happened to them at some time or other, and, consequently, a lasting impression is made.

The following quotation is a typical educational bulletin covering the procedure to be followed in the event of control-circuit trouble with multiple-unit operation of Diesel-electric locomotives: "We recently experienced a serious delay on one of our passenger trains due to a faulty control jumper receptacle of the leading unit. The trouble was manifest only when the locomotive came to stop, at which time the three units comprising the locomotive relaxed due to spring action of the draft gear. This caused movement of the control jumper cable and the defect showed up, causing erratic operation of the Diesel engine.

"In event of control circuit trouble of such a nature in multiple-unit operation, the first step to be taken is the isolation of the unit at fault, which can be done by removing control jumpers between units. With the trouble isolated to a particular unit it can more easily be traced down and corrected. If trouble cannot be located it might be possible to move and operate the train with the remaining units to some point where assistance is available by leaving the defective unit isolated. If trouble is on the leading unit and it is necessary to clear the main track, the fireman or supervisor can furnish power from the trailing unit, or units, with the engineman retaining control of the brake from the leading cab."

Such information as contained in the above bulletin gives every man in engine service an opportunity to profit by the other fellow's experience. Not only is attention called to the poor performance, or failure, but bulletins often call attention to instances where poor performances were prevented by displaying exceptional ability. For instance, in a case of intermittent ground protective relay operation, the fireman disconnected the transition indicator lead at the meter shunt, eliminating a ground in the high-voltage circuit, and enabling the locomotive to continue to the end of its run with full tonnage. This event was publicized by means of the educational bulletin.

What the Engine Crew Should Know

The fireman of today will be the engineman of tomorrow, and through progressive examinations will acquire knowledge of the fundamental or basic principles of the equipment. He should be able to explain the proper procedure to follow in putting a sequence check on the electrical equipment to determine why the engine is not carrying its load. Therefore, if the progressive examination to cover Diesel operations has not been revised, its revision should seriously be considered. Either an operating manual furnished by the manufacturer, or one prepared by the railroad should be made available to enginemen and firemen. When this has been done, engine service men leave the terminal with little fear that they will be unable to cope with any reasonable occurrence.

The road foreman of engines in steam-locomotive operation had the problem of the human equation in getting enginemen to handle the locomotive to get maximum efficiency by coordination of the reverse lever and throttle manipulation. With Diesel power there is no difference between enginemen in this respect as the Diesel engines respond the same for any engineman in a given throttle position. However, the road foreman of engines does have a problem in Diesel operation not encountered in steam operation. While the Diesel engine is protected from overloading by automatically operating electro-mechanical devices, there is no protection given to the electrical transmission; this the road foreman must protect by training enginemen never to stop with the power applied or attempt to start until the brakes are fully released and always to operate with the traction motors in the proper series or series-parallel connection as determined by locomotive speed.

In selecting the proper motor connections, the engineman should use the transition meter as his sole guide if this instrument is in good condition and operating properly. There is a general tendency among enginemen to become speed recorder conscious. No damage will result in failing to advance the transition lever with increasing speed, but serious damage will result and the electrical equipment will be overloaded if the lever is not backed off at the point indicated when the locomotive speed is decreasing due to grade or otherwise.

When a power plant fails, the remaining equipment will be overloaded to complete the run. Enginemen justly pride themselves in bringing the train in under such circumstances, but the road foreman must definitely have it understood that the electrical equipment must not be overloaded under any circumstances and when a loss of power is experienced, that the train must be reduced proportionately.

Role of Supervision

Supervision requires a constant follow-through of the ground work to overcome irregularities on the road which result in delays and failures. The dissemination of information regarding a particular piece of equipment to enginemen, or the qualification of an engineman for Diesel-electric operation, does not and should not leave the thought that the particular individual is a finished product or that he has all the answers. This is a fallacy indulged in by some supervisors, and in my opinion is the dividing line between supervisors and supervision. It is here that supervision begins.

In discussing Diesel-electric operation the importance of following through must not be overlooked. The mere fact that instructions are issued does not mean that results will follow. Results are obtained only when the instructions are followed through. Follow-through means to keep the subject alive constantly, and to keep hammering until the thoughts register.

The ability to instruct is the essence of the ability to manage. The supervisor cannot expect intelligent cooperation from his men until they have been given an intelligent understanding of what he wants them to do. Instructions must be made clear, complete and interesting. The reason why certain instructions are issued and why they must be complied with must be included. Men will give their best cooperation when the supervisor helps them to understand exactly what he is striving to accomplish. The supervisor should respect their intellect as humans and show a sincere interest in helping them get results.

The members of the committee are W. D. Quarles (chairman), assistant chief motive power, A. C. L.; G. Stewart, superintendent air brakes, F. E. C.; C. Wenk, superintendent air brakes. A. C. L.

Discussion

During the discussion representatives of a number of railroads cited their experiences in training Diesel engine crews. There was agreement of at least two railroads that the average man acquires enough knowledge after four round trips to operate Diesel-electric locomotives. Differences in the methods of instruction to which men respond were also cited. Some men seem to learn best by being told and then doing it themselves; others do best by watching the instructor perform the operations. In either case, written instructions are the best basis for training. More than one speaker referred to the importance of the fireman. It does not take long to teach enginemen to operate the Diesel, but reliance has to be placed on the fireman to become a competent trouble shooter. The real problem lies in the engineroom.

On the Missouri Pacific from four to seven road foremen at a time are taken to a major terminal for a week where they are in charge of the Diesel electrical supervisor, mechanical supervisor, and air-brake supervisor, each to cover his own field. Questions and answers have been prepared which these men must digest and understand before they leave. Hundreds of copies of these questions and answers are passed out to the enginemen and firemen. Since this was done, troubles have been much reduced. Troubles encountered by the crews are broadcast. First, the situation is described; second, the cause of the difficulty is outlined, and, third, the remedy is set forth.

On the Atlantic Coast Line the same condition has been observed: the enginemen and firemen are keen to learn what has happened to other crews so that they may learn in advance to avoid similar difficulties. Bulletins concerning failures are issued to meet this situation.

Air Brake Association Revived...

Papers at the Meeting

* The F-2 Lubricator for Air Compressors, by George Ferguson

* Aftercoolers and Automatic Drain Valves, by Frank Ellis

Fundamentals of No. 6-BL Brake Equipment, by H. W. Sudduth

* Terminal Testing of the H. S. C. Brake, by R. G. Webb

* Effect of Heating Sheds on Air Brakes, by K. E. Carey

** Papers indicated by asterisk appear in this section.*

Air Brake Association Joins the Coordinated Associations

Wide variety of air brake topics presented in papers read and discussed at own meetings and joint sessions with other associations

W. F. Peck,
President

W. E. Vergan,
First Vice-Pres.

R. C. Cousens,
Second Vice-Pres.

R. G. Webb,
Third Vice-Pres.

F. C. Goble,
Sec.-Treas.

THE thirty-ninth annual convention of the Air Brake Association held in Chicago from September 15 through 17 considered papers on the No. 6 BL brake equipment; aftercoolers and automatic drain valves; type F-2 lubricators; the effect of heating sheds on air-brake devices; and testing electro-pneumatic brakes on light-weight trains. The Association met with the Locomotive Maintenance Officers' Association for the joint consideration of the report of the latter on air brake maintenance and with the Railway Fuel and Traveling Engineers' Association for the consideration of passenger and freight train handling, a description of the No. 24RL brake equipment, and the relation of wheel characteristics to sliding.

The attendance at the meetings and the extensive participation in the discussion in the first meeting since 1937 confirmed the judgment of those who arranged for the revival of the association this year. The total registration was 183, of which 14 were women, 55 were guests, and the remaining 114 were members.

In his opening address, W. F. Peck, president of the Association, emphasized the fact that opportunities afforded this organization had never been brighter in view of the many new developments in power brakes and the thirst for knowledge of the brakes on the part of thousands of railroad officers and employees. He went on to say that the general committee of the Mechanical Division of the Association of American Railroads was convinced that the organization is sorely needed due to the educational nature of its work and that permission had been received to proceed with the association's labors as a full member of the Coordinated Mechanical Associations. He described the only restriction in so far as work within the association's scope is concerned as being that subjects on train handling would be dealt with by the Railway Fuel and Traveling Engineers Association; but that that restriction is more than off-set by the fact that in the future all air-brake

papers must be submitted by the Air Brake Association.

At the conclusion of the meetings the following officers were elected to serve during 1947-48: President, W. E. Vergan, superintendent of air equipment and Diesel operation, Missouri-Kansas-Texas lines; vice-presidents, R. C. Cousens, general supervisor of air brakes and train control, Boston & Maine; R. G. Webb, superintendent of air brakes, Chicago, Milwaukee, St. Paul & Pacific; and C. E. Miller, superintendent of air brakes and steam heat, New York Central system. C. V. Miller, general supervisor of air brakes, New York, Chicago & St. Louis, was elected a member of the executive committee. F. C. Goble, general air-brake supervisor, New York, New Haven & Hartford, is secretary-treasurer.

Papers presented at the sessions of the Association and the discussions which followed are set forth below.

The F-2 Lubricator for Air Compressors

Air compressor operation and reliability has been improved and periods between repairs extended by the use of the F-2 mechanical lubricator which itself requires little upkeep

By George Ferguson

General Air-Brake Inspector, Central Region, Pennsylvania

For years air-compressor lubrication has not received the attention which its importance deserves. Proper lubrication of both the steam and air cylinders will pay big dividends. The steam cylinders were first oiled by hydrostatic lubricator. Later on the automatic air-cylinder oil cup was developed, but this cup was not sufficient to provide lubrication for extended locomotive runs.

With the advent of the locomotive mechanical lubricator a problem was presented to the air-brake supervisor as the compressor received no lubrication when the locomotive was standing. Consequently, when the locomotive arrived on the ash pit, the compressor received no lubrication until the locomotive was dispatched and out on the railroad. The intervening period may be from two to twenty-four hours, and in many cases the compressor is kept in operation during this time. This results in the compressor leaving the enginehouse with dry steam cylinders. The locomotive moves out to the yard and couples to the train and proceeds to charge the brake system on 100 or more cars with the result that when the locomotive finally gets the train under way the compressor is so dry it is almost impossible for it to operate.

George Ferguson

To remedy a situation of this nature the F-2 mechanical lubricator was developed. This is an individual mechanical lubricator for the compressor that holds sufficient oil to maintain proper lubrication of the steam and air cylinders over any length of run to which the locomotive may be assigned. It is a self-contained unit which is fastened to integral brackets on the air cylinders and is operated entirely by the compressor, thus providing lubrication to the air and steam cylinders at all times while the compressor is in operation. The F-2 is simple in design and operation and is built rugged for long service.

The Pennsylvania first became acquainted with the F-2 mechanical lubricators during July, 1943. Since that time a total of 850 F-2 mechanical lubricators have been placed in service. Through-passenger locomotives have been entirely equipped, and compressor failures have steadily decreased in proportion to the number of lubricators applied. In my region during July, 1945, there were 386 minutes delay chargeable to compressors stopping on passenger locomotives, while for July, 1947, there were only 57 minutes. These were 3,244 miles per minute failure for July, 1945, and 18,768 miles per minute failure for 1947.

Proper Grade of Oil Important

No. 1 cylinder oil was at first used in the F-2 to lubricate both the steam and air ends. This type of oil was efficient for the steam end but it did not prove entirely satisfactory for the air cylinders due to the large accumulation of carbon deposited on the discharge valves and discharge passages. While the lubricator has separately marked oil compartments for the steam and air ends, our experience with two grades of oil was unsatisfactory. At times light oil was found in the steam-end compartment and heavy oil in the air-end compartment.

Tests of various kinds of oil to find a lubricant suitable for both the steam and air ends showed refined cylinder oil, specification 211A, to be satisfactory. The use of this oil for both the steam and air ends permitted the removal of the dividing plug between the two oil compartments. This oil has been in use for approximately 18 months and has proved very successful in lubricating both ends of the compressor, although it was necessary to change the adjustments of the pumping unit for the high-pressure air cylinder to provide a smaller quantity of oil. Our recommended adjustment of the pumping units for 100 revolutions of the camshaft is: 60-70-cc. for the steam end; 4 cc. for the low-pressure air cylinder; 2 cc. for the high-pressure air cylinder.

With the first F-2 lubricators manufactured and applied during the war period considerable difficulty was experienced due to the necessity of frequent priming. A redesign of the pumping-unit bushings provides a self-priming feature.

Trouble was also experienced with the actuating piston, ring and bushing due to wear and grooving. This trouble was overcome by the application of a special iron alloy for the actuating bushing, the composition of the piston and ring remaining the same. The actuating-piston bushing and piston-and-ring assembly has been in service approximately one year and examination after this length of service did not disclose any appreciable wear.

There has never been any occasion to replace any pumping units or bushings due to wear. Locking nuts on the pumping units were found loose, but this has been corrected by the application of a Z-type lock washer.

There was some trouble due to the personnel that filled the lubricator removing the oil filling screen, which resulted in dirt getting into the oil chambers. This has been materially reduced

by the application of a strainer which extends almost to the bottom of the oil chambers, permitting faster filling of the chambers and therefore eliminating the incentive for removing the

On single-compressor installations it is our practice on passenger locomotives to remove the compressor for repairs after nine months of service, at which time the F-2 lubricator is removed with the pump and sent to the central air-brake shop for cleaning and repairs. Repairs are not being found necessary, but the lubricator is cleaned and checked for proper adjustment. A test rack has been developed for this purpose. Consideration is being given on locomotives having a single-compressor installation to operating those compressors equipped with F-2 mechanical lubricators from shopping to shopping.

With the two-compressor installation the compressor and lubricator go from shopping to shopping of the locomotive. This type of locomotive receives class repairs after 100,000 miles. Repairs to the F-2 mechanical lubricator itself have been slight.

Discussion

C. C. Maynard, chief inspector of air brakes, Canadian National, asked what results were obtained using the same grade of oil in the air cylinder and the steam cylinder. Mr. Ferguson replied that 18 months experience indicated good results. A regular filtered cylinder oil is used summer and winter. No heaters are required to keep the oil warm, but there is a means of applying heat to the lubricator. Locomotives equipped with the F-2 lubricator also have the Type-G filter, which is another big item in cutting down compressor failures and extensive repairs.

E. T. McClure, supervisor of air brakes, Atchison, Topeka, & Santa Fe, said that their F-2's are doing a good job of lubricating, but there has been more work on them than on some of the other lubricators. Another-type lubricator has been in service seven years with no parts renewed, but only cleaning it when the locomotive was shopped.

W. E. Myers, air brake inspector, Louisville & Nashvile, remarked that placing the strainer out on the front end of the locomotive avoids sand, dust, etc., and considerably improves performance. Discussion revealed that the only difficulty encountered with this location occurred during snow drifts.

Aftercoolers and Automatic Drain Valves

A discussion of methods employed to reduce the amounts of oil, dirt and water that enter the air-brake system

By Frank Ellis

General Air-Brake Instructor, St. Louis-San Francisco

How to eliminate oil, dirt and water or reduce the amount of each to a minimum where they will not adversely affect flexible operation of the various valvular parts is a subject which deals with the proper installation, design and maintenance of the compressed-air plant—whether on a locomotive or stationary.

The first consideration in all compressed-air plants is the compressors. They should have ample capacity to permit intermittent running under the maximum load to prevent overheating. The maintenance of compressors is equally as important as capacity. On the St. Louis-San Francisco, the maintenance of locomotive air compressors is done at a centralized point where we have the proper tools and trained men to do this important work.

Reducing Oil in the Brake System

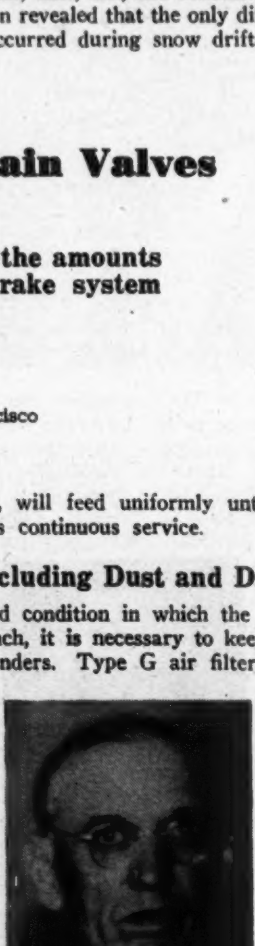
Oil, dirt and water in the brake system are separate though related subjects. One item of repairs that is most beneficial towards reducing the amount of oil carried into the brake system is the clearance between the air pistons and cylinders. This clearance is held to .001 in. for each inch of diameter but does not exceed .012 in. for diameters larger than twelve inches. Holding the air end to these clearances is a great help to the packing rings in holding lubrication on the pistons and cylinder walls. This is due to a minimum of leakage by the rings and in turn requires a minimum of lubricant to hold this good condition. There being practically no leakage past the rings, a full cylinder of fresh air is drawn into the compressor and a full cylinder of pressure is delivered to the reservoirs each stroke of the pistons. The heat generated by compressing the air is held to a minimum usually far below the temperature required to vaporize the oil.

Owing to the good condition of the air cylinders which reduced the heating it was possible to get away from valve oil for lubricating air cylinders of cross-compound compressors and to use a good grade of light mineral oil approaching S.A.E. 30.

To eliminate excessive amounts of oil in the air-brake system it is necessary to use an oil cup that will only feed the amount of oil needed to lubricate the air cylinders and not flood them. An oil cup known as the single-unit cup is used. It has a capacity of 2.8 oz., will feed uniformly until empty, and will last about 50 hours continuous service.

Excluding Dust and Dirt

To keep the good condition in which the air cylinders leave the overhauling bench, it is necessary to keep the dirt and dust out of the air cylinders. Type G air filters are standard for the Frisco and all 8½-in. cross-compound compressors are so equipped. Before using the Type G intake filters it was necessary to launder the air cylinders each three months—in the dust-bowl territory once each month. Since applying Type G intake filters and single-unit cups using S.A.E. 30 mineral oil, all laundering has been stopped.



F. Ellis

Where two 8½-in. cross-compound compressors are applied to a locomotive, we have found we can get at least four years service out of the compressors before overhauling. In a check of the wear of the rings, bushings and cylinders of two cross-compound compressors equipped with Type G filters and single-unit oil cups that had been in service four years on one locomotive, it was the opinion of the air-brake foreman that they

could have given satisfactory service for at least one more year. He reports the cost of material and labor to repair these two compressors was $64.24, or an average of $8.03 per year for each compressor. On the strength of this check and the good condition found, compressors on this class of power are removed when the locomotive is shopped for flues, whether it be four or five years, or longer if the locomotive has been in white lead.

Care of the Steam End

It would not be to any material advantage to have air cylinders able to give four, five or six years service unless the steam end of the compressors could also give an equal amount of service before shopping becomes necessary. The same close fitting and alignment of parts is given to the steam end that is given the air end while the compressors are dismantled in the shop. When placed in service, ample lubrication is always given the steam end while the compressors are running.

The steam end of compressors are lubricated by both hydrostatic and force feed lubricators. The hydrostatic lubricator is started whenever the compressors are started, in the enginehouse or elsewhere. Instructions are that the hydrostatic lubricator will be set to feed one drop per minute all the time the compressors are running. The oil feed from the hydrostatic lubricator goes through the governor, while oil from the force-feed lubricator is delivered to the steam pipe between the governor and the compressors. This method insures ample lubrication to the steam end at all times. There are no reports of governors sticking, which is a good indication that the rules requiring the hydrostatic lubricator to be turned on when starting the compressor are carried out.

Eliminating Water

It has been the common practice to attempt to cool the air in two stages, first by a long iron discharge pipe, usually in the form of a coil connecting the compressor to the first main reservoir, and secondly, by using another length of iron pipe usually in the form of a coil between the reservoirs. While this installation of iron pipe is of some benefit, in general, on modern heavy power it does not cool the air sufficiently to prevent an excessive amount of water being deposited beyond the reservoirs in the brake system.

The number of main reservoirs and necessary lengths of iron pipe that can be installed on practically all locomotives is very limited and our experience to date proves it is very doubtful that the use of iron pipe alone will satisfactorily cool the compressed air. Copper has much better conductivity than iron, which means a copper radiator or coil of ample capacity for cooling air will occupy considerably less space than that required for iron pipe of equal capacity.

In 1936 the Frisco applied to a rebuilt locomotive a fin-type copper-tube radiator in the discharge line between the two 8½-in. c. c. compressors and the first main reservoir. This installation was carefully followed and it was observed that considerable water was precipitated in the first reservoir on the left side of the locomotive. In the second main reservoir, also on the left side of the locomotive, a lesser amount of water was found. The first and second reservoirs on this type of locomotive are connected by approximately 18 inches of pipe. On the right side of the locomotive is a third reservoir in which no water is ever found. Many observations were made of the brake-pipe hose coupling on the tender at the moment the hose was separated from the freight car. At no time was there any evidence of water passing through the hose.

The quick-action chamber of the KM vent valve, the ports in the pedestal brake valve leading to and from the F feed valve, the centrifugal dirt collectors and strainers were carefully examined each cleaning period and never was there any evidence of any oil or water having been present. Ten more locomotives were equipped in the same manner and same results were obtained. To date, thirty-four 4-8-2 type locomotives have been equipped.

In addition to the 4-8-2 type locomotives, ten semistreamline 4-6-4 type locomotives have been equipped with fin-type radiators. This locomotive has one 8½-in. cross-compound compressor located on the left side of the boiler, and the fin type radiator is located on the front end under the smoke box behind the streamlining. A section of this covering was cut out and covered with front end netting to permit a circulation of air around and through or past the fin tubing of the radiator.

Before equipping the semistreamlined locomotives with fin-type radiators, considerable water was getting into the equipment. After the radiators were applied there was no more evidence of water at the brake-pipe hose on the tender. There is, however, evidence of a slight amount of water accumulating in the 1¼-in. main-reservoir filter located in the main-reservoir pipe under the cab. About a teaspoonful collects in the filter in a 200-mile run with a train consisting of nine or ten cars and making from 35 to 50 brake applications.

The piping on the semistreamline locomotives is different from the piping on the 4-8-2 type locomotives. In both cases, the radiator is located on the front end of the locomotives. The radiator on the 4-8-2 type is in the discharge line close to the compressors, while on the semistreamliners it is cut-in between the first main reservoir on the left side and the second main reservoir on the right side. Locating the radiator between the reservoirs is in accordance with the latest recommendations of the brake companies, who recommend the radiator type of aftercooler for brake-equipment schedules on steam, Diesel, or electric locomotives.

Automatic Drain Valves

Limited experience with the automatic drain valve showed that it would keep the reservoirs drained when properly cared for. A few years ago automatic drain valves were applied to six passenger locomotives, but soon after the application the locomotives were changed to other assignments, and the close checking given at the start of the test was not continued. In time, because of not having close supervision, the drain valves that were screwed into the reservoirs filled with scale and grit and became inoperative.

With another application the drain valve was attached to a bracket to the main frame in front of the cylinder saddle to drain the fin-type radiator. Due to unsuitable clamping and vibration the drain valves were broken. It is felt that if the locomotives had remained in the territory where they were first started these failures would not have occurred.

In all of our installations brake-cylinder pressure was used to operate the drain valves. The numerous brake applications on our railroad made such an application practical so we have no experience with governor operation.

Discussion

W. B. Weightman, general air brake inspector, Pennsylvania, asked if one drop of oil per minute was applied to all types of locomotives, if the same amount was used where the drops vary in size, or in the case of a switching locomotive. He asked how the size of the drop is arrived at, and what kind of oil is used in steam engines.

Mr. Ellis answered that while running the compressor, the steam end gets oil from the mechanical lubricator and the one drop is satisfactory. It will be about ⅛ in. in size, from the tip. The lubrication from the mechanical lubricator has proved very satisfactory, and is one of the things that has kept compressors out of trouble. Lubrication of the steam end has helped keep absolute compressor failures down to two in the last six years on the Frisco.

L. D. Hays, air brake engineer, New York Central, said that in some cases freeze ups of the tender brake pipe occurred and were traced back to the compressor piston-rod packing and the swab. Removing the swabs showed the condition of the piston-rod packing and the piston rods themselves. The oil ran down the side of the pump to the ground eventually, and the swab, after a few months service, became so thoroughly saturated with water, it caused it to shed the oil, and the water, being abrasive, wore out the rods.

After removing the swabs and changing from a metallic to a non-metallic piston-rod packing, the pumps ran 200,000 miles or more without wear on the rods.

R. G. Webb, supervisor of air brakes, Chicago, Milwaukee, St. Paul & Pacific, asked, in setting up the performance of an air compressor, if it is the proper barometer of the compressor's performance to say that it has been in service for four years or six years. That doesn't mean too much because, if the locomotive is in white lead or double-pumped or has been in suburban service or secondary service, the compressor hasn't

done much work. A better way is a mileage basis. That determines what the compressor has done. Whether the locomotive has a single pump, is in heavy-duty freight service, in passenger service, etc., is the basis to determine the length of time the compressor should be out. With a single-pump locomotive in heavy-duty freight service, the mileage is limited to 75,000-80,000 miles. With a single-pump locomotive in heavy-duty passenger service, 125,000 to 140,000 miles is enough. At that time, 99 per cent of the time possibly, the compressor will take the orifice test, but it is doubtful that this is a good barometer for a single-pumped locomotive in heavy-duty service. On a double-pumped locomotive, regardless of the service, the pumps are run until they fail on the orifice test. Valve oil is used in the steam end, and a special oil in the air end that contains a detergent which eliminates carbon. The G-type filter is used and is good, but a filter alone will not prevent air-pump failures.

Chairman Peck remarked that the B. & O. does not place pump performance on either a mileage or time basis as they operate over both level divisions and mountain grades where retainers are used. The only equitable basis for pump life between overhauls would be single strokes, which is out of the question. On mountain divisions where automatic drain valves are operated the pumps strike a balance where the governor does not properly operate the drains. To overcome that, permission was secured from the I. C. C. to equip 30 roller-bearing-locomotive valves with type NS-16 governors.

H. I. Tramblie, air brake instructor, Chicago, Burlington & Quincy, said that Burlington practice is practically the same as Mr. Webb described. Where a pump works water the lubrication is washed off the steam valves and the pump is liable to stop. The pump that has the best and the tightest rings in the air end will probably stop quicker than some of the others. To overcome the lack of any appreciable leakage by the rings, a small hole was drilled through the low-pressure air piston, and that has overcome the steam valves not reversing properly. The greatest trouble is not with cross-compound compressors but with power driven compressors on Diesel locomotives. On most locomotives the water has been eliminated from the air system by making radical changes in the main-reservoir piping, but this has not eliminated the oil. That can be cut down by the careful fitting of rings and by getting rings that will run through longer mileage than the ordinary ring which is being standardized on the C. B. & Q. Nevertheless, the oil problem is still there. Everyone who has any ideas on the subject has been consulted and have had nothing but negative answers. One man suggested that, by creating a vacuum in the crank case of the compressor, you could stop the oil pumping, and that has some merit. A test has been run recently which hasn't developed too well for the reason that no method of creating much of a vacuum in the crank case has been found. Apparently, these power driven compressors pump oil when they are unloading, and in order to counteract that and always to have less pressure below the piston than above it, the idea of creating a vacuum should work. The question is how to create that vacuum? A 1¼-in. vacuum in the crank case doesn't seem to be enough. Some form of pump could be used to create a vacuum, or possibly a jet could be used. It is a serious problem because this oil gets into all parts of the brake equipment and necessitates the removal and cleaning at great deal shorter periods than would be necessary if it weren't for the oil.

Chairman Peck mentioned that the trouble with the automatic drain valves on the B. & O. was due to an emulsion of oil clogging them.

Joseph Vargo, Chicago enginehouse foreman, Baltimore & Ohio, said that quite a bit of water and oil is found in the reservoirs with the automatic drain, and that sometimes they don't work at all.

F. C. Wenk, superintendent of air brakes, Atlantic Coast Line, thought that one of the answers to troubles with Diesel-electric locomotives having oil in the system has been found to some degree on an Alco switcher with a separate drive to the compressor. It only works when the compressor cuts in. Unfortunately, locomotive builders force the continuously driven compressors on the railroads. They won't permit, in some instances, getting away from the present drive. On one Diesel F-T-type locomotive water has been eliminated, but there is still a fog in the cab sometimes when the brakes are applied. The thing that will eventually work it out will be a separate drive to the air compressors on Diesel-electric locomotives.

Secretary F. C. Goble, general air brake supervisor, New York, New Haven & Hartford, said that on locomotives with the hydrostatic lubricator, considerable pump trouble was experienced because the oil, when the hydrostatic lubricator was turned on, was free to pass through the pipes to the governor and on to the compressor. On occasions with a Type A governor, the oil that should be going through the pump was by-passed, causing the pump to run dry. On practically all locomotives, particularly in passenger service, the NS-16 governor with the F-2 lubricator has been adopted. Since the adoption of the NS-16 governor, pump stoppage has been eliminated. The NS-16 governor is ready to cut in when the compressor is ready. When it maintains or reaches the 140-lb. mark, the governor cuts in automatically and the pump starts. The compressor has gone as long as eight or nine minutes without making a stroke. In answering Mr. Webb, Mr. Goble added that the New Haven has gone longer than four years with the installation of some compressors, which will pass the orifice test each time and do a good job. Before the compressor has given any trouble, 382,000 miles have been run. The compressor remains in service until the third failure, when it is removed. In answer to Mr. Tramblie with respect to oil accumulation in the Diesel locomotives, Mr. Goble said that the New Haven also accumulates quite a lot of oil. When the G Type filter is removed, not much oil is in it, proving that the oil by-passes that right along with the air and accumulates up around the region of the brake valve. On electric locomotives, the oil was not thought to be detrimental to any brake equipment. In fact, years ago, the manufacturers put an oil plug at the brake valve so that oil could be shot in there. If the engineman is asked if he drained the reservoirs and made the prescribed brake valve test, invariably he will say "No." If they will show a little interest in their jobs and open the drains on the reservoirs, drain that condensation and emulsified oil out, and place the brake valve in emergency position before they leave the terminal, oil will not be found in the equipment.

C. O. DeWitt, Westinghouse Air Brake Company, said, in answer to Mr. Tramblie's remarks about creating a vacuum, that the Y-3CD type of compressor creates a vacuum and has a check valve on it. That is one of the principles of partly reducing oil passing in connection with running unloaded. Therefore, in the unloaded operation, though not pumping, enough pressure is created on top of the pistons to keep the oil passing down. The main thing to watch in the compressor is that the intake filters are kept clean because that restriction will cause carboning. Governor synchronizing requires all compressors to work the same, each cooling system to do its own work, and one unit is not overloaded.

Chairman Peck's experience with governor synchronization on Diesel units operated in multiple was that compressors do not get as warm and do not pass as much oil.

C. C. Maynard, chief inspector of air brakes, Canadian National, said that on general-service and heavy freight locomotives, the pump seriously deteriorates after 14 months and a mileage of 114,000 to 140,000. Main piston rings are in good shape after 140,000 or 150,000 miles, but the top head rings are not in as good condition. The air valves are worn considerably, he couldn't see how four or five years, or three or four hundred thousand miles could be attained from a pump in freight service. In answer to Mr. Hays on piston rod swabs, metallic-type packing is used on the Canadian National. There was excess oil in the system, using the King standard hookup with a swab jacket at the King packing cup. The oil came through the swab and was syphoned or sucked up into the air cylinders. Removing the oil cups and the swabs improved the piston-rod service. There are no bad effects without packing. The lubrication going through the air cylinders takes care of the metallic packing.

Mr. Webb thought automatic drain valves in the compressor steam end a monstrosity. Personnel were injured in the inspection pit, in the roundhouse, and at other places where the valve operated without warning. Also, the automatic drain valve closes when there is a little pressure against it, leaving water in the various passages and channels of the steam pipe and steam connections to the air compressor which is carried over and through the pump and out the stock, destroying the lubricant. A manually operated drain valve can be left open until the water has been emitted from the channels.

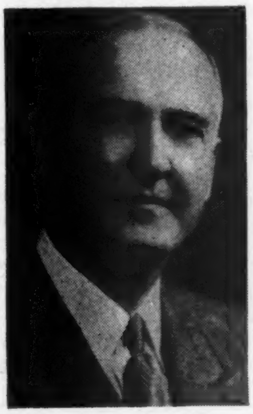
Terminal Testing of the H. S. C. Brake

An outline of testing procedure for both automatic brake and electric straight-air control on electro-pneumatic brakes before train departure from the original terminal

By R. G. Webb

Superintendent Air Brakes, Chicago, Milwaukee, St. Paul & Pacific

Before testing H. S. C. brakes, the brake pipe and reservoirs on the units to be tested must be charged to the maximum pressure. If the tests prescribed herein are to be made with the power unit attached, the charging of the brake system as well as the application and release of the brakes, may be made with the power-unit equipment. If the tests are to be made with the power unit detached, provision must be made to charge the brake system and to apply and release the brakes with automatic brake control and electric straight-air control. Before coupling either the power unit or the test truck to the train for charging, the brake pipe on the power unit and yard supply for the test truck must be blown out in order to exclude the possibility of dirt or moisture entering the brake system. The brake test truck used in making these tests is similar to the standard test truck except that it has additional equipment for testing high-speed train-brake equipments. If the test truck has the MS-40 or the DSE-24-H brake valve, after the pneumatic tests are completed the shifter lever on the brake valve can be turned for the electric tests. If the test truck is not equipped with either the MS-40 or the DSE-24-H brake valve, necessary provisions must be made for energizing and de-energizing the application and release wires. With either set-up, provisions must be made for th supply and control of the required voltage for which the relays are adjusted. This should be between 58 and 75 volts.



R. G. Webb

As the brake system is being charged, the following observations should be made:

1—Check the brake system for leaks.

2—Observe that angle cocks and cut-out cocks on the brake-pipe, straight-air-pipe, and signal-pipe hose connections are open.

3—Check foundation brake rigging and safety hangers. Observe that all nuts are tight, cotter keys properly applied and the locking device on slack adjusters is in place.

4—Piston travel is adjusted in accordance with individual road instructions—generally, double-acting truck-mounted cylinders, 2 to 3 in.; single acting truck-mounted cylinder 4 to 5 in.

Pre-departure Tests

When operating with electric straight air control, before departure from the yard or original terminal, an air-brake test on H. S. C. trains must be made with automatic brake control and electric straight-air control as follows:

1—If the test is to be made with the power unit attached, the engineman's brake valve is changed for automatic brake control, the brake magnet switch opened, the brake system fully charged and the brakes released.

2—Upon receiving the application signal, a 15-lb. brake-pipe reduction is made and the brake-valve handle left in lap position. The brake-pipe leakage is noted as indicated by the brake-pipe gauge, which must not exceed 5 lb. per minute, after which the reduction must be increased to 25 lb.

3—After the brakes are applied, the inspector walks the entire length of the train examining brakes to determine that they are applied on all cars. When this inspection has been completed, the signal to release the brakes is given by opening the air-signal car discharge valve on the rearmost car from which the signal can be given. It is recommended that the back-up valve on the rear car, if the train is being tested as a unit, be opened wide before releasing. The engineman or carman making the test should note whether the brake-pipe pressure is depleted to zero and the brakes applied in emergency.

4—Upon receipt of signal, the brake-valve handle is placed in release position with H. S. C. equipment and running position with 24-RL brake equipment. The independent brake, if the power unit is being used for testing, is left fully applied.

5—After the brakes are released, the inspector walks the entire length of the train examining the brakes to determine that they are released on all cars.

6—When the above shows the braks to be functioning properly, the engineman's brake valve is changed for electric straight air and the brake magnet switch closed.

7—With the brake system fully charged and the brakes released, an electro-pneumatic application of not less than 30 lb. is made.

8—After the brakes are applied, the inspector walks the entire length of the train to determine that the brakes are applied on all cars. When this inspection has been completed, a signal is given for releasing the brakes.

9—After the brakes are released, the inspector walks the entire length of the train to determing that brakes are released on all cars.

10—If the rear car is equipped with a DE-1 back-up valve, it is tried at this time to determine if the hot wire and the common negative return wire are intact. Defective conditions are corrected before the train is permitted to depart.

If tests are being made with the test truck, the same procedure should be followed in testing the brakes pneumatically. After the pneumatic part of the train brake is tested properly the straight-air pipe is coupled to the test truck. Necessary electrical connections are made to the application and release wires of the train. The brake-pipe feed valve of the test truck is set to maintain 110 lb. brake-pipe pressure. The straight-air pipe feed valve is set to close at 75 lb. With the power unit attached, the straight-air pipe pressure is determined by the setting of the application and release spring in the brake valve.

When making the No. 1 application and release tests, the following should govern:

1—Th test is begun with all electric connections properly made, the circuit breaker switch in "on" position, the voltage supply adjusted as specified above, the brake valve handle in running position, and both the brake pipe and straight-air pipe coupled to the test truck.

2—The release and application magnets are energized; the straight-air pipe should then charge from 0 to 70 lb. in 3 to 4 seconds.

3—The brakes are released by de-energizing the application and release magnets.

4—The brakes are reapplied to 70 or 75 lb.

5—The application magnet is de-energized. After the straight-air pipe pressure has settled, the leakage is noted. This should not exceed 5 lb. for one minute. The brakes are released and applied again in steps to insure that proper graduation is obtained in both application and release. While this is being done, observations are made to insure that the magnet portions on each car are operative. This may be observed by the inspector listening to the magnet valves clicking.

After the above tests and inspections as previously outlined have been made, the speed governor which is generally used on H. S. C. applications is tested.

To conduct the speed-governor tests properly there must be available a test box, Westinghouse Air Brake Company Piece 516667 for testing 32- and 64-volt equipment, or Westinghouse Air Brake Company Piece 1532114 for testing 32-, 64- and 100-volt equipment. This so-called "black box" has a toggle switch which the controls the battery supply to the test box. Toggle switch No. 2 is a polarity or directional control switch, toggle switch No. 3 is a double-pole, double-throw switch for checking generator and relay circuits; toggle switch No. 4 is a single-pole, single-throw switch for checking speed-governor control and directional relay; toggle switch No. 5 is a single-pole for 32 and 64 volts. In addition to the above toggle switches, there are also push-button switch No. 6, which is used to bypass the generator circuit, and push button No. 7, which short circuits the battery when momentarily placed down. Battery terminals are also provided for use with the relay cabinets which are equipped with six test jacks.

After all electrical and air connections are properly made—circuit breaker switch and supply voltage adjusted as specified—and the test-truck brake-valve handle placed in running position, the brakes are applied, text-box switches Nos. 3 and 4 moved to "B" position, and text box switch No. 1 to "B" position. If the directional repeater relay does not become energized, which will be indicated by failure of the relay-cabinet indicator lamp to light, the left hand rheostat is moved slowly in a clockwise direction until the directional repeater relay does become energized and the light comes on. The main battery switch is opened, the rheostat knob moved to extreme counter-clockwise position and switch No. 1 moved to "A" position. Then, by closing the main battery switch, if the relay cabinet indicator lamp fails to light and 60 per cent brake-cylinder pressure is obtained on the brake-cylinder gauge, it indicates proper drop-cut of the directional repeater relay. The pick-up of the directional repeater relay should not exceed 5 volts.

In testing the speed-governor relays and relay magnets, without moving any of the test-box switches, the left-hand rheostat knob is moved to extreme clockwise position and the right rheostat knob moved in a clockwise direction a sufficient amount for the high-speed governor relay to pick up. The brake-cylinder gauge should then register 100 per cent brake-cylinder pressure. The right hand rheostat knob is gradually moved in a counter-clockwise direction, thus reducing the voltage until the high-speed relay drops out, reducing the brake-cylinder pressure. The pressure should reduce to 80 per cent. This test is repeated until the medium-speed and low-speed relays drop out.

To assist the closing and opening of the speed-governor relays and eliminate fluttering of these relays due to the resistance change at the moment of closing or opening, there are inductive kick circuits to give a momentary impulse at the time of opening or closing. These circuits are like a simple transformer and derive their induction from the opening or closing of the circuit through the coils of certain relays.

Characteristics of the Equipment

A magnet valve pumping indicates:

1—That brake-cylinder pressure is increased and decreased with the brake-valve handle in the straight-air application position. This could be caused by leakage into the control pipe or leakage from the control pipe.

2—Leakage into the straight-air pipe through the magnet application valve or leakage from the straight-air pipe by the magnet-valve exhaust. Close the cut-out cock in the straight-air pipe to the magnet valve to be tested. If the pumping stops, one of the magnet valves is at fault.

3—Improper lift of the magnet valve. The valve lift on all magnet valves is 1/16 in. After a defective magnet valve is cut out of service and with the test brake-valve handle in release position, the air brakes on the locomotive unit or car having a defective magnet valve should start to release. If a blow of air continues at the magnet-valve exhaust after the cut-out cock is closed, it will not interfere with operation of the brakes; the application and release of brakes on the car affected will be controlled from adjacent cars. Cutting out the 21-B magnet valve on one car will not materially affect the operation of the electric straight-air brake on the train as the magnet valves on adjacent valves will supply air to and release air from the straight-air pipe, which will apply and release the brakes on the car with the magnet valve cut out of service.

4—Improper adjustment of the contacts in the master controller.

Brakes failing to release following straight-air application on the train indicates that the master controller may not have de-energized the release electric circuit due to improper adjustment of the contacts.

Brakes failing to release during test on a single car indicates a bad leak past the magnet application valve. De-energize the application and release circuits to the magnet valves and close the cut-out cock in the straight-air pipe connection to the magnet bracket. A strong blow at the magnet bracket indicates leakage past the application magnet valve.

Brakes not releasing on an individual car indicate that the application magnet valve has less than the prescribed lift and does not reduce the auxiliary-reservoir pressure below the brake-pipe pressure during a straight-air brake application. The cut-out cock in the straight-air pipe is closed to the magnet bracket.

Operation

1—The D-22-BR control valve is equipped with a double check valve located on pipe-bracket portion to provide for the electric straight-air-brake in addition to the automatic-brake operation.

2—The 1864 relay-valve performs the function of former Type B relay valve with additional features of electric magnet valves providing high braking ratios in proportion to train speed with speed governor control cut in service.

3—The A-2 quick-service valve transmits local quick-service activity from car to car when operating in automatic control.

4—The 21-B magnet valve admits and releases air from the straight-air pipe when operating under electric straight-air-brake control.

5—The axle generator mounted on the end of the roller-bearing box provides an operating voltage for the speed-governor-control relay panel when cut in service.

6—The whistle signal system is conventional steam-road standard.

Fuses for the protection of electric signal circuits are located in the electric locker. After completion of all tests and correction of defective conditions, the foreman or officer in charge should be notified of results.

Discussion

Several members discussed the question of whether, when operating electrically with H. S. C. brakes, it is necessary in road train-brake tests to test the brakes pneumatically in order to comply with the I.C.C. law. All who spoke preferred to test the brakes electrically where nothing is done to the train except to change crews, inasmuch as the double test is given at the initial terminal. It was also mentioned that the fact that the electric brake is working on each car indicates that the automatic brake system is in order, the train line open, and the reservoirs charged. During the discussion it was revealed that the A.A.R. plans at the next meeting to appoint a committee to draw up a set of road tests for the high-speed brake for presentation to the I.C.C. for approval.

H. L. Tramblie, air brake instructor, Chicago, Burlington & Quincy, said that taking the pressure from the auxiliary reservoir instead of from the supply reservoir eliminated a succession of stuck brakes. In reply to a question, he stated that brake-shoe wear will be cut almost in half through the use of the electric brake, as compared with the automatic brake, on the same train and schedule.

Effect of Heating Sheds on Air Brakes*

Damage to air-brake parts caused by heating sheds to thaw coal described—Maximum allowable times and temperatures within the shed—How to prevent troubles from this cause

The subject of the effect of heating sheds on air-brake devices has been one of some concern among railroads handling coal, in which the nature of the coal is such that it must be wetted before loading and thus must be thawed to permit removing at the point where it is to be used. This subject became particularly active back in 1941 with the increased use of heating sheds over older methods of using torches, live steam and other heating means for disengaging the coal from the hoppers of the car.

The heating shed provides a relatively quick means of loosening up the coal so that it can be removed from the car to the plant, shipside or powerhouse storage bin. The modern heating shed permits enclosing a definite number of cars, which are brought above normal room temperatures by means of steam through pipes located under the cars or by hot air brought in through blowers. These pipes and the heated air are generally

K. E. Carey

considerably above that of the normal room temperature, and it is this condition that must be controlled. Practice has shown that the higher the temperature the quicker is the thawing out of the frozen coal, although it has the disadvantage that where the temperatures are raised too high, they become critical to the car parts themselves, including the air brake devices and associated parts.

When such heating plants were first placed in service, and particularly during periods of the year where the outside temperatures were relatively low for long periods of time, the tendency to raise the heating sheds to relatively high temperatures prevailed, resulting in damage and even failures to certain air-brake parts. This damage was manifested in the form of distorted air-hose gaskets, loose air hose and clamps, and baked triple-valve gaskets which no longer provided a seal. While some of these conditions were detected immediately, others did not become apparent until the equipment had departed from the terminal and failed on the line, causing train detentions. Further damaged internal parts were found when valves were tested on the racks.

This focused particular attention on just what temperatures could be tolerated without interferencse with the normal operation of the brake equipment after the car had been unloaded and again placed in revenue service. Checks have shown that there have been cases where such cars were held in the heating sheds for periods of from 7 to 18 hours, and temperatures adjacent to the car were raised to approximately 200 to 250 deg. F. Such temperatures, particularly when held for relatively long periods of time, adversely affect the brake devices, particularly such parts as the hose, gaskets, brake-cylinder packing cups, the various lubricants used in the brake cylinder and brake parts, and even some of the bushings and die metal castings.

Allowable Heating Times and Temperatures

A study made by the Westinghouse Air Brake Company indicated that the AB brake equipment parts would be affected by elevated temperatures in such parts as the lubricants, the Wabcolite or non-metallic parts, the zinc-die metal castings, and the hose and gaskets. It was determined that where cars were placed in the heating sheds for periods of not longer than one hour, maximum temperatures in the neighborhood of 200 deg. F: could be tolerated without damaging the brake-cylinder lubricant. This applied to lubricants meeting the latest A. A. R. specifications, where the tendency for the oil and the grease to part is less than in most of the older forms of brake cylinder lubricants. Where temperatures above this point were encountered and for even short periods, the brake cylinder lubricant deteriorates quickly and there is some deterioration of the Wabco brake cylinder packing cup itself. Where temperatures exceeded 200 deg. F., and where such temperatures were held for longer than one hour even the latest A. A. R. brake-cylinder lubricant deteriorates at a considerably accelerated rate. Such a condition results in aging of the Wabco cup and the gaskets and flange fitting seals, lowering their strength and resiliency and possibly affecting the actual operation and performance of the brake devices. The zinc-die castings are apt to warp slightly under the bolting strains at the higher temperatures, which results in gasket leakage, effecting brake-pipe or train-line leakage. The Wabcolite bushings are affected by temperatures exceeding 275 deg. F., particularly where such temperatures are maintained for any appreciable period over the specified one hour.

A study could be given to a thawing cycle so controlled as to permit high temperatures at the start when there is a maximum mass of coldness to overcome and then a tapering off of the shed temperature down to safe limits as the temperature of the equipment is raised.

To soften the coal effectively for ready removal, some cars are left in the heating sheds for periods of from 7 to 18 hours. A special record was made by an eastern railroad covering 21 cars, the purpose being to observe the normal recorded temperatures, the time the cars are in the shed, temperatures at the car and the brake devices, and the time the maximum temperatures are maintained. In general, they showed times in the shed of from 7 to 18½ hours, maximum normal recorded temperatures in the shed of from 125 to 204 deg. F. and maximum temperatures at the brake devices, as obtained from temporarily located special recording devices, of from 122 to 216 deg. F.

Under the above conditions, it is recommended that the temperature be not higher than 175 deg. F. at the devices. For periods of from 1 to 2 hours, the adjacent temperatures could be raised to the higher figure of 200 deg. F. Further checks were made at which time it was found that for temperatures exceeding 200 deg. F., and where the cars were subjected to these temperatures under air pressure, the die metal castings might become distorted resulting in some leakage, so that the temperatures should be kept below the 175 deg. F. figure, where the temperatures are to be maintained for the longer periods of from 7 to 18 hours.

Temperature Measurement

Some of the more modern heating sheds have rather elaborate temperature recording devices which can be placed near the cars for checking temperatures existing adjacent to the brake devices and other parts of the car itself. However, some of the devices are remotely located from the cars so that they do not properly record the temperatures immediately adjacent to the car. Too much emphasis cannot be placed on temperature control since quite a few sheds are equipped with only recording devices and no means of controlling or adjusting the maximum temperatures.

There is another simple method of checking temperatures

* Paper of the Manhattan Air Brake Club, presented by President K. E. Carey, general air brake inspector, Pennsylvania.

which has been found rather effective and that is through the use of so-called "Tempil Sticks." These are colored crayons which permit marking on the side of the valve, brake cylinder or any desired part on the car itself. These sticks will melt at different predetermined temperatures in steps of 25 deg. F. so that by using three sticks, set to melt at temperatures of 150, 175, and 200 deg. F., it is possible to mark the valve with the three different-colored crayons to determine just what the maximum temperatures have been at the valve. These tmperatures are revealed by the crayon marks which have melted and turned black, permitting a ready check on the actual temperature existing at the point of application of the crayons. The sticks are readily available and permit the recording of temperatures at points where recording pyrometers and similar instruments cannot readily be placed when the cars are in the heating shed.

Protecting Brake Devices

There have been several other possible suggestions in the elimination of brake troubles in heating sheds, such as the removal of the brake devices, hose, etc., prior to placing the cars in the shed. This is not too difficult when it comes to the various hose and brake devices themselves, though it is not particularly suitable for the brake cylinder which is not readily removed as a complete unit. However, the piston can be removed and the lubrication checked after the shed temperatures have been brought back down. It may be rather difficult to remove brake devices in some of the larger heating sheds, although this could only be determined by further study of the problems there.

It is not believed that the average shipper involved in the operation of heating sheds realizes the importance of maintaining controlled temperatures in the thawing of coal. When higher temperatures for extended periods may be used, further study should be given to the possible removal of the brake devices before placing such cars in the shed, or possibly protecting such devices with a suitable hood or insulating material that would keep the temperatures adjacent to the devices down to that recommended by the brake manufacturers. This latter arrangement, however, may not be too practical since for extended periods of time, it can be expected that the temperature inside of the protected hoods would invariably reach that of the surrounding car, and, therefore, result in the same damage as where no protection were used.

Some thawing sheds, in addition to radiated heat, utilize water sprays, which, after striking the car, drain on heated lines and the water is turned into free steam which adds penetrative qualities to the heat. In sheds of this type, a cold water spray could be played on the critical parts, triple valve and brake cylinder, to keep the temperature of these parts in a safe range and at the same time provide more water for the generation of free steam. Possibly this procedure could be combined with the use of the protection hood or shield.

Though a somewhat more complicated arrangement, it does not appear impossible to arrange the pit portion in the shed to be at a lower temperature than the car body and to arrange for hooding the various brake devices within this pit area. This may appear to be a rather elaborate arrangement requiring relocation of the heating pipes, though in the long run it may pay dividends by protecting the brake devices. It may not be too far in the future when heating can be accomplished faster and without any damage to equipment through the use of electrically induced heating, a set-up wherein the current would flow from the car body to lines or to an electrode placed in or adjacent to the lading which would uniformily raise the temperature to a point high enough above freezing to permit thawing and yet low enough to prevent damage to the lading.

We understand that some study has also been given to the use of a device for vibrating the car for the purpose of loosening up the coal. This apparently has some merit in that it eliminates the heating problem. It probably would also be effective when combined with the heating shed operation functioning within recommended temperatures. There is the possible problem of the vibration affecting the piston bushings of the brake equipment which, of course, would have to be checked; though probably for the short vibrating periods encountered, the resultant shock would not be harmful to them.

There are no rules governing heating sheds, and it is up to the shipper, at his own discretion or through information provided by the railroads from the airbrake manufacturers, to supervise his temperature control to protect the brake equipment. It is realized that the shipper is primarily interested in having his commodity removed from the car as quickly and cheaply as possible and there is apparently little doubt that high temperatures for long periods is effective in accomplishing this. However, it does result in increased maintenance and possible failures of the brake devices, and, in many cases, such failures are not detected until after the cars are placed in revenue service, thereby causing costly train delays. We feel that on the whole this abuse of equipment is the result of the parties responsible not fully understanding the problem and thus not aware of the magnitude of the situation.

It is important to check the brake equipment on cars as they leave the heating shed. However, where proper cooperation is obtained between the railroad and the shipper, it appears that there could be a considerable reduction in the amount of equipment lost on cars passing through heating sheds as a result of excessive temperatures. Considerable additional study could be given to this problem having in mind the determination of the best results for thawing the coal and still providing a minimum amount of damage to the brake equipment.

The problem of the heating shed is one that is not limited to the brake parts only. Many of the other freight-car parts such as journals, waste, packing, paint, etc., are seriously affected, though in this paper we are particularly interested in the effect of the heating shed on the brake devices, hose and gaskets themselves.

Discussion

L. D. Hays, air brake engineer, New York Central System, mentioned that the New York Central and their customers use oil-fired open flames for emptying hopper cars, and the AB valve being near the slope sheet is damaged by the heat. By placing the control valve at the car corner the slope sheet heat is avoided. This location should be brought to the attention of the A. A. R. as it also permits easier servicing by allowing the brake inspector to stand along side the car in the performance of his duties.

D. R. Collins, superintendent of air brakes, Denver & Rio Grande Western, said that difficulty was experienced with one shipper who was interested only in getting ore out of the car. This shipper preferred to pay for the damage caused by excessive heating rather than to lengthen the thawing time. This delays movement of the cars as they must be sent to repair tracks for a thorough inspection before returning to road duty.

L. A. Stanton, general air brake inspector, Great Northern, stated that the substitution of vibrating machinery for heating to unload ore shook the car badly and damaged the equipment.

Attendance at the Coordinated Mechanical Meetings

Association	Members	Guests	Total
Air Brake	183	24	207
Master Boiler Makers	257	80	337
Car Department Officers	294	370*	664*
Fuel and Traveling Engineers	495	47	542
Locomotive Maintenance Officers	414	29	443
Allied Railway Supply	808	..	808
Totals	2,451	550	3,001

*Includes visitors to exhibits who may not have attended the technical sessions.

Train Handling - Fuel - Personnel Training

on program of

R.F.&T.E.A.

Addresses and Reports at the Meeting

- * Why Good Coal Is Hard to Get
- * A Technical Revolution Under Way
- * Supervisors Are Human Engineers
- * Handling Long Heavy Freight Trains
- * The Reduction of Objectionable Smoke
- * Front Ends, Grates and Ash Pans
- * What Size Coal for Locomotives
- * Separate Steam and Diesel Fuel Reports
- Operating Traits of Diesel Locomotives
- Review of Valve Motion Developments
- Coaling Plant Objectives
- Wheel Behavior on Low-Adhesion Rails

** Reports and addresses indicated by asterisk appear in this section.*

Road Foremen's Program Varied

Nine committees report – Papers are presented on two subjects – Two officers of railways, a locomtoive builder, and a mine operator address the meeting – Smoke abatement extensively discussed

W. C. Shove
President

A PROGRAM dealing with train handling, coal economics and dispensing, smoke abatement, certain aspects of the steam locomotive affecting its operation, and the training of enginemen and firemen-helpers for Diesel-electric locomotives was presented to a well-attended annual meeting of the Railway Fuel and Traveling Engineers' Association held at the Hotel Sherman, Chicago, September 15-18. Participating in a joint opening session with the other four railway bodies constituting the Co-ordinated Associations, it also contributed the report of a committee, of which W. D. Quarles, assistant chief of motive power, Atlantic Coast Line, was chairman, on training Diesel enginemen and firemen, to a second joint session of four of the associations devoted to personnel problems. A report of the joint sessions, including this paper, appears elsewhere in this issue. The report of the Committee on Front Ends, Grates, Ash Pans and Arches was also presented at this session, but is included with the other reports presented at the individual sessions of the Railway Fuel and Traveling Engineers' Association.

Two addresses were presented also on Diesel subjects: one by W. A. Callison, vice-president, American Locomotive Company, on the Diesel locomotive, and the other by P. H. Hatch, general mechanical superintendent, New York, New Haven & Hartford, on the operating characteristics of Diesel-electric locomotives. An address by J. D. Loftis, chief of motive power and equipment, Atlantic Coast Line, dealt with the responsibilities of supervisors in handling personnel problems.

At a session attended also by the members of the Air Brake Association the report of the Air-Brake Committee, of which W. R. Sugg, general supervisor air brakes and lubrication, Missouri Pacific, was chairman, was presented. This included papers on handling heavy passenger and heavy freight trains. Papers were also presented on the relation of wheel and rail characteristics on wheel sliding, by L. D. Hays, air-brake engineer, New York Central System, and on the No. 24RL brake equipment, by C. D. Stewart, vice-president, Westinghouse Air Brake Company.

Dealing with steam-locomotive fuel problems were reports of three committees, one address, and one paper. The reports dealt with the unit cost of coal, A. A. Raymond, superintendent fuel and locomotive performance, New York Central System, chairman; with coaling-station design for satisfactory operation, Glenn Warner, fuel supervisor, Pere Marquette district, Chesapeake & Ohio, chairman, and with fuel statistics, A. A. Raymond, chairman. R. F. Ireland, president, Hanna Coal Company, addressed the meeting on the factors responsible for the current coal situation, and J. M. Bishop, chemist, Truax-Traer Coal Company, presented a paper dealing with the functions of coal-preparation plants at the mine and methods for their control. This paper was a contribution of the Coal-Preparation Committee, M. B. Adamson, fuel supervisor, Chicago, Rock Island & Pacific, chairman. Smoke abatement was the subject of a report by a committee of which G. B. Curtis, road foreman of engines, Richmond, Fredericksburg & Potomac, was chairman.

Valve motion was the subject of a report, presented by W. C. Wardwell, master mechanic, New York Central, committee chairman. E. E. Chapman, mechanical assistant, Atchison, Topeka & Santa Fe, was chairman of the committee which presented a report on lubrication.

Election of Officers

During the meeting the following officers were elected: President, S. A. Dickson, transportation assistant, Gulf, Mobile & Ohio; vice-presidents, G. B. Curtis, road foreman of engines, Richmond, Fredericksburg & Potomac; W. R. Sugg, general supervisor air brakes and lubrication, Missouri Pacific, and W. E. Sample, superintendent fuel conservation, Baltimore & Ohio. The members of the Executive Committee who will continue to serve until the next election are R. D. Nicholson, road foreman of engines, New York, New Haven & Hartford; W. D. Quarles, assistant chief motive power, Atlantic Coast Line; E. G. Sanders, fuel conservation engineer, Atchison, Topeka & Santa Fe; F. T. McClure, supervisor air brakes, Atchison, Topeka & Santa Fe. Elected to serve for two years are G. Warner, fuel supervisor, Chesapeake & Ohio, Pere Marquette district; G. E. Anderson,

general fuel supervisor, Great Northern; and A. O. Geertz, fuel engineer, Pennsylvania System. T. Duff Smith continues as secretary-treasurer.

The secretary-treasurer reported total funds available for the year of $11,010 and current expenses of $10,258. The registered attendance was 657, of which 480 were members, 47 guests, and 130 ladies.

President Shove's Remarks

In calling the meeting to order the president, W. C. Shove, general road foreman of engines, New York, New Haven & Hartford, reminded the members that they were in attendance for no purpose other than to serve the railroads and that they could do that by faithful attendance at all sessions and by contributing freely of their experience in the discussions as well as by absorbing the best ideas advanced by others. Insuring the correct handling of passenger and freight trains and the elimination of unnecessary dense smoke are responsibilities of traveling engineers and fuel supervisors, he said, which play an important part in building satisfactory public relations.

Abstracts of most of the reports and addresses follow. Some of the remaining reports and papers will appear in subsequent issues.

Why Good Coal Is Hard to Get

At least six reasons are set forth by the author—Questions complacency toward steam locomotive handicaps

By R. L. Ireland

President, Hanna Coal Company, Cleveland, Ohio

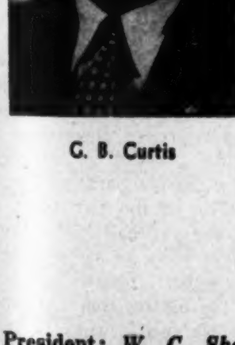
Since you saw me last year, I have been given a new title. I like it very much. I am now the officer in charge of dispelling complacency, and complacency is a good topic for this occasion.

The railroads, like many other businesses, have shown tremendous improvement. I saw some figures just the other day that 7 per cent less locomotives in service in 1945 than in 1935 traveled 600 million more miles. So what? It is very easy to show improvements when you are doing a lousy job. I have shown a lot of improvement in my coal mines, and I have kidded my directors and my boss that I was a hot-shot. But in my own heart I know I haven't even scratched the surface on what should and can be done. I think that holds true in the railroad business as well.

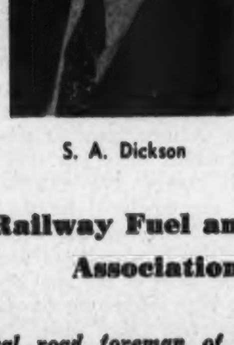
Just because we made a little improvement, there is no excuse for complacency.

Availability and Utilization

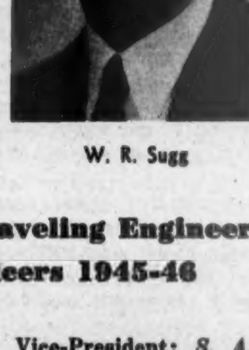
Availability is something I hear a lot about these days, and so I tried to find out what it means. I find that different industries have different explanations of availability. I understand that in the railroad business it is the number of hours in the day that a locomotive is not either in the shop for repairs



G. B. Curtis



S. A. Dickson



W. R. Sugg

T. Duff Smith

Railway Fuel and Traveling Engineers' Association Officers 1945-46

President: *W. C. Shove, general road foreman of engines, New York, New Haven & Hartford, New Haven, Conn.*

Vice-President: *G. B. Curtis, road foreman of engines, Richmond, Fredericksburg & Potomac, Richmond, Va.*

Vice-President: *S. A. Dickson, transportation assistant, Gulf, Mobile & Ohio, Bloomington, Ill.*

Vice-President: *W. R. Sugg, general supervisor air brakes and lubrication, Missouri Pacific, St. Louis, Mo.*

Secretary-Treasurer: *T. Duff Smith, 327 South La Salle street, Chicago.*

or inspection or broken down on the system. The rest of the day is availability. Then, I followed that up to find out what utilization meant. I found that utilization is the number of hours in the day that a locomotive is coupled to a train.

That to me is one of the nicest little figures that you could possibly have because the operating department can pass the buck to the maintenance-of-equipment department and the maintenance-of-equipment department can pass the buck to the operating department and, between the two, the fact that the locomotive is working but half time gets lost in the argument.

Coal mining is a little different because your mine is running or it isn't. When it is running that is utilization and when it

R. J. Ireland

is idle that is not utilization. You have the added complication of fitting your available motive power to trains to move.

If I may offer a suggestion, you might get some of the alibis out of the game if utilization were thought of as the percentage of time that an engine is in service out of the hours that it is available. Then you can charge the hours that it is not available to the maintenance department and the hours it is not in use to the operating department and neither can pass the buck.

Grandmother's Tales

My pet gripe is the fact that every railroad has a lot of good steam-propelled reciprocating locomotives and that they are not giving them a break. If I permitted our machinery to be out of service as much as the railroads permit their steam locomotives to be out of service, I would get fired, and properly so! Aren't you letting, should I call it a grandmother's tale, guide your judgment? The old, old habits that were handed down by generation after generation: never take your woollen underwear off until the Ides of March, and always drink some kind of sassafras tea on the third of April every year to clean out your system for the summer—all that bunk.

Isn't there a lot of that in a lot of the practices that are going on on a lot of the railroads today? They are afraid to take a chance. Afraid to try something new. You are afraid to be reponsible for making a mistake or of trying something that doesn't work the first time. You are afraid that if you try something, they will get impatient with you and order you back to your old practices before you have had a chance to work out something new and better. That is complacency in my language. Don't be afraid of getting away from complacency! That is what built America and that is what is going to save the world—the American system of jumping in and doing something new that has never been heard of or tried before. We certainly need that on our railroads today.

Last year I talked about fuel. I told you that it was your own fault that your availability wasn't greater because you don't use the proper kind of fuel; that you ought to get your purchasing agents to buy the kind of coal that you ought to have. I told you that your locomotive performance supervisors ought to determine the kind of fuel you ought to have. Now you will pass the buck back to me and say, "Why don't you give it to us? We are asking for it and we can't get it."

A Change in the Fuel Supply

It might be interesting to some of you to know what the cause of that is. First of all, the State Department has determined that one of the things that we must do to help Europe is to send them a lot of coal. That is taking coal away from home use. In addition to that, it is slowing down the movement of cars because it takes longer to send coal through to tidewater and get the cars back to the mine than it does to send it to the customers on the line or to the lakes, because the tidewater facilities have not been developed for the volume of business they are trying to handle. That is one of the reasons why coal is scarce.

Another reason is that, since the war, a great many other industries are calling for open-top rolling stock. This morning, I saw trainload after trainload of coal cars filled with sand and gravel and scrap metal. A great many more care are being tied up in that kind of service now than during the war, and that curtails the amount of cars available for coal.

Another reason is that our customers—I am not referring to the railroads because they always held coal in cars—but our regular customers who were working triple shifts seven days a week during the war and were unloading equipment promptly, aren't doing so any more and that is a delay which has slowed down the turn-around of cars.

There is another thing—I would do the same thing if I were running the railroads and I don't blame them—a lot of them have been running in red ink lately because their revenues don't match their expenses, and, therefore, they have been trying to curtail expenditures. They do it in two ways: (1) bad-order cars are accumulating; (2) overtime is not being used to move cars as rapidly as they might otherwise move.

One more thing—you are using the same car rating rules that were used in the case of hand-loading mines. In a hand-loading mine on a two-day run an operator couldn't possibly cheat more than 10 per cent because he couldn't accumulate enough cars of coal loaded ahead to amount to more than that. In a mechanized mine today it is practically impossible to increase production for a given day or two days over the normal run because the number of cars used is exactly integrated to the capacity of the loading equipment. The strip mine, however, is a very different case. In strip mining, the coal is uncovered ahead and then it can be loaded into trucks and taken to the tipple for loading in railroad cars at any time it seems convenient. It is simple for a strip-mine operator, on the days that he is going to get a car rating to borrow trucks from all the neighbors and to put to loading coal some of his shovels that are normally used for uncovering coal and establish a car rating two or more times our sustained capacity.

A great many of the strip mines in this country today haven't the cleaning facilities and the sizing facilities to give the railroads the kind of coal they want and need. They take it up as it comes—some of it would be better sold as real estate than as coal—load it over a ramp as mine run and you take it and like it. The big mines with cleaning and sizing facilities are running three or four days a week.

Those are the reasons why you aren't getting the kind of fuel you ought to have to get good availability out of your equipment. Until something is done about these various points, you are going to have to get along as best you can and it is a shame that you do! I wish I could do something to help you, but I admit that I have so far not succeeded very well.

Complacency and Steam

Being in the coal business and being an American citizen, as you all are, I have a two-fold interest in getting the greatest availability and use out of steam locomotives. The railroads have an investment in them. They have proved themselves to be capable units, but they aren't getting a break as compared to the Diesel. The reasons primarily are the comparative figures that are published on the relative merits of the two types of units. I am awaiting the day when some railroad has nothing but Diesel locomotives and their figures have to be presented on the basis of the pool of the entire number. That is going to be a very interesting comparison with the figures that are being dished out today where they are put on special runs because of their tremendous initial cost and the preferred service is compared with the pool of standard locomotives.

I can quote a lot of you, off the record, about as follows:

"It's a shame that we can't get better facilities for servicing our steam locomotives."

"It's a shame that we can't get the same word passed down

from the top to get the full use of our modern locomotives that we do on the Diesel locomotives."

"It's a shame that we can't get some minor expenditures made to improve our coal docks, watering, and ash-disposal facilities."

If my friends on the railroads can tell me those things off the record, why can't you gentlemen do something about it *on* the record? We stand ready to help you in any way we can, but the thing has got to originate with you. Then, if we can be of assistance to you—I mean the coal operators who are equipped to give you the fuel you need and who are always ready to help you in any way they can—we will get behind you.

There are many manufacturers of steam locomotive parts and I have been told by railroad men that their products represent advancements in the art. I say, "Why don't you use them?"

"Well, they haven't been tried out enough."

"Are you trying them out?"

"No; we are waiting for some other railroad to try them out and if they prove successful, we will try them."

Let George do it! Our company wouldn't be where it is today if we had waited for George. We try to see how far ahead of George we can keep ourselves all the time. We would not last long as shippers of coal on your railroads if we didn't keep ahead of George. So, in addition to locking complacency in the closet, let's see if we can't get ahead of George.

The coal operators—I was one of them—used to rejoice every time we saw a lot of smoke coming out of a chimney. That meant they were wasting 25 per cent of the coal they had bought and they would have to buy 125 per cent of their requirements—that was swell. But competition caught up with us in the form of oil and gas and the public is getting awfully tired of smoky cities. We have had to change our tune and it is good business to do it. If, by the elimination of smoke you can reduce the cost of maintaining a home in the city, that is progress and it should be supported.

I was recently talking to a group of retailers trying to urge them to educate their customers in better firing practice and I put this up to them: How many of you would go in the liquor store, buy a bottle of liquor, pay for it, pull the cork, pour 25 per cent of it on the floor, shove in the cork, and go home with the balance? How many of your wives would go to the butcher shop, buy a T-bone steak, pay for it, borrow the butcher's knife, cut off the tenderloin, toss it in his face, and carry the rest of it home? That, gentlemen, is what is happening when you see smoke—and the railroads are guilty of that!

I ask your support in the interest of the general welfare, in the interest of avoiding restrictive legislation, to do more than you are doing for the elimination of smoke. It is not economical, it is not popular, and it is doing your industry harm.

A Technological Revolution Under Way

By W. A. Callison

Vice-President, American Locomotive Company

Last fall the first of a new line of Diesel-electric road locomotives made its debut in New York. This was the seventy-five thousandth locomotive built by American Locomotive Company since its earliest ancestor went into business more than 100 years ago. But that fact is only an interesting incidental. What mattered was that American Locomotive had succeeded—beyond its best expectations—in doing something it had set out to do

W. A. Callison

nearly ten years ago. There is no question in our minds that this new locomotive is a truly significant advance in locomotive power.

But that occasion seemed to have another significance—a significance greater than any single locomotive no matter how revolutionary. The railroad industry in this country is on the threshold of a technological revolution—and is already well into the earliest stages of it. There is every good indication that the railroad industry has started on a change-over from steam power to Diesel-electric power with all that this implies.

The steps in this direction have been gradual to date. For example, there were 42,413 locomotives on line in this country at the end of 1945 and only 2,981 of them were Diesel-electrics. It is true that 86 per cent of the mileage was run during 1945 by steam locomotives. Even in the switching field, where the Diesel-electric far outclasses steam power, 75 per cent of the mileage for the same year was turned in by steam locomotives.

But the great number of steam locomotives only emphasizes the magnitude of the revolution which is already in progress. The forces at work are revealed by the figures for locomotive orders. In 1935, for example, 20 per cent of locomotive orders were for Diesels. Two years later the figure was 40 per cent. Four years later it was 62 per cent. Six years later—just before the war—it was 76 per cent. Today the domestic demand for locomotives is overwhelmingly for Diesel-electrics—approximately 95 per cent.

The magnitude of the revolution will be indicated further by the fact that the depreciated value of steam locomotives as carried on the books of Class I railroads was close to two billion dollars at the end of 1944.

Diesel-Electric Cuts Costs

How can such a change be justified? More than anything else it is justified by economy. There is no doubt in the minds of those who have given this whole subject the closest study that the Diesel-electric can materially cut railroad costs. It has a far greater availability than the steam locomotive. In the switcher field where the Diesel has made the greatest initial progress a steam switcher is available for active duty only about 40 per cent of the time, whereas the Diesel can be in service more than 90 per cent of the time. In road service the Diesel has not only the advantage of availability, it also has the advantage of being able to go without water, and we have found out how to make it eliminate pusher locomotives in many parts of the country where it is necessary to climb mountains. Because the Diesel-electric makes fewer stops for servicing on long runs—such as in the West, especially—it makes better time schedules. Moreover, faster acceleration contributes to the maintenance of higher average speeds. This also has a special significance to the West where perishables are an important part of your freight.

The truth of the matter is that our railroads find themselves continually squeezed between rising costs from below and hard, fixed ceilings of rates above. They must be economical and fight for survival in that narrow space between costs and rates.

Favoring the technological revolution also is the improvement in financial condition which was made possible by the magnificent job done by American railroads during World War II. They had the advantages of tremendous loads for a long period and were able to get out of debt.

The war not only helped railroads get into the soundest financial condition they have enjoyed for a very long time, but it also wore out great quantities of old equipment. Add the third fact, that the Diesel-electric came of age as the most economical form of power at this particular moment in railroad history, and you have the essential facts which lead to our belief that a revolution in railroad motive power has begun.

The Alco-G.E. Line

We of American Locomotive Company have been working with the General Electric Company in the development of our new road Diesels and our whole new Diesel line. The war handicapped the research which we were doing. We had to set aside much of it and we were under government orders to make no road Diesels during the war period. But the war gave us and General Electric experience which has proved of great value to our joint effort. G.E. made major contributions to American aviation during the war—in the field of the supercharged gasoline engine, for one thing. Out of that experience G.E. engineers were able to develop the turbo supercharger used in the new Alco-G.E. road locomotives. It is capable of doubling the power output of the Diesels without increasing weight.

There is something else which seems to give this year 1947 special significance in the field of railroad power. The new Alco-G.E. Diesel-electrics are being built by mass methods.

Still Room for Steam

We do not, by any means, believe that the steam locomotive is dead. Within the past year we have built steam locomotives that have set a record of 52,000 miles of service for a 60-day period on one of the nation's foremost eastern railroads. Furthermore, there are railroads which run through coal districts, have large interests in coal mines, and carry coal as their principal item of freight. In some cases as much as 70 per cent of their freight is coal. They will continue to need and want coal-burning locomotives. As a matter of fact, our company is now experimenting in the use of powdered coal and carrying on research with steam-turbine and gas-turbine locomotives.

But when all this has been said, there is still the clear fact that we are actually in the era of Diesel-electric power. The research, and the changeover of our plants for mass production fo Diesel-electrics represents an investment of $20,000,000 by American Locomotive Company. That investment will indicate to you that we look upon the transition of the railroads from steam to Diesel power as something very real.

Manufacturing Objectives

The general objectives of our assembly-line procedures are: efficient and economical production; the manufacture of interchangeable parts and sub-assemblies so that they are available at all times for service; and thorough planning, scheduling and production control, to effect low cost of manufacture, and the meeting of customers' requirements.

We have designed and built a 1,500-hp. combination switcher and road locomotive; a high-speed freight locomotives in multiples of 1,500-hp. units; and the high-speed passenger locomotive in multiples of 2,000-hp. units, which made its bow in New York last fall. This locomotive and those that have followed it have since confirmed all claims made for it.

Two 2,000-hp. units were given exhaustive tests on the Lehigh Valley. The results will, I think, interest you. This 4,000-hp. locomotive had a continuous operating range between 23 and 100 miles per hour. The continuous hauling power of that locomotive was 50,000 lbs. tractive force. The 4,000-hp. locomotive handled fast passenger trains between Buffalo and New York, in both directions, and without any helper service. The locomotive had to be able to run at speeds up to 90 miles per hour and yet handle the heavy drags of the two per cent grades out of Ithaca and Wilkes-Barre without any help.

There is something else we should have in mind in looking at the rising trend toward the Diesel-electric. The bill for damaged shipments on American railroads last year was about one hundred million dollars. Railroads, competing with bus and truck and plane carriers, have a great deal to gain from cutting that bill. It isn't simply a matter of cutting costs, it is a question of eliminating a source of conflict and annoyance with respect to the shipper. A new power-plant-regulating system on our new Diesel-electrics—using both hydraulic and electric controls—provides smoother stops and starts and gentler handling all along the line. We hope to make our contribution to reducing that one hundred million dollar cost.

Supervisors Are Human Engineers

By J. D. Loftis
Chief of Motive Power and Equipment, Atlantic Coast Line

Engineering brains and ingenuity have changed our thinking from the steam locomotive of yesterday to the poppet valve steam locomotive, steam-turbine-electric locomotive, Diesel-electric locomotive, and are now engaged in perfecting the gas-turbine-electric locomotive for practical service. From my knowledge of the skill that is latent in the engineering field today, I should not be surprised if the gas-turbine direct drive, and possibly an atomic energy locomotive were not in the early development stages. Certainly, the knowledge and imagination that created the modern ultra-refined coach train of today and the luxurious Trains of Tomorrow will not be deterred by any problem of providing freight and passenger equipment and motive power necessary to provide fast, economical, and efficient rail transportation before future demands are made upon the railroads. More far-thinking railroad managements are looking toward the future and asking their mechanical departments for equipment with which to merchandise transportation rather than awaiting demands by shippers for services. All of this, and more, will be provided by investors in an effort to keep the railroads ahead of demands.

Now, let us examine that which welds the fine equipment, locomotives, right-of-way, rails, spikes, signals, communications, and other highly engineered items into the efficient rail transportation network of today. Millions of dollars can be invested without any chance of success until the human element has been introduced. This railroad structure may be likened to the human body in that, until life is breathed into the body, the best conditioned and proportioned frame is useless. It is, therefore, apparent that, without the human element, this multi-billion dollar structure is useless.

I have attempted to illustrate the technical engineering effort that is expended in developing and maintaining the material structure of rail transportation. Yet, how much effort is expended toward engineering human relations? I am afraid that too little importance is given to this feature. Such pioneers as F. K. Mitchell of the New York Central, J. Gogerty of the Union Pacific, W. J. O'Neill of the Western Pacific, and W. H. Sagstetter of the Rio Grande have placed emphasis upon training of mechanics for the shops of these great systems. Others, such as H. J. Schulthess of the Rio Grande, have gone further and instituted educational programs for supervisors, but, to my knowledge, none has devoted full engineering efforts toward the development of educational programs for employees and supervisors alike. Such commercial firms as the General Electric, Westinghouse, Lincoln Electric, Wilson & Co., General Motors, and

others far too numerous to list here have developed supervisory and personnel programs to the utmost with the result that no commercial advertising program can equal the good will engendered by the collective supervisory and working groups of these companies. The success of these firms is ample proof of the wise course they have pursued. The Atlantic Coast Line has probably taken the most important step of any recent advances in this direction by establishing in their shops stabilized employment.

How can this human engineering be accomplished? By the combined efforts of all supervisory personnel. Who is the most important factor in this direction? The local direct supervisor. I do not mean by this that it is his responsibility alone because, without the support of his superiors, he cannot carry the burden. Assuming, however, the wholehearted cooperation of the chief

J. D. Loftis

of motive power, the road foreman has in his hands the applied science of human engineering.

Too much time is being spent by road foremen attempting to correct past faults rather than taking preventive action prior to the fault. It is time for us to take stock of our programs, map a concise course, and take definite action to implement the necessary steps. From the standpoint of the road foreman his most important responsibility is to know his men. Errors occurring as the result of aggressive action when not repetitious are much more explainable than lack of action on the part of an individual who is fully conversant. It is contingent upon the road foreman to single out those men most in need of assistance and concentrate upon them. Very few men actually want to do a poor job. Conversely, most men are capable of doing something well. Of course, there are those men who, through lack of foresight or careless selection, become a round peg in a square hole by selecting for their work an occupation for which they are not equipped, but with close supervision this becomes apparent during the first few months of employment and they should be persuaded to accept another line of endeavor. There are certain fundamentals which we require our supervisors, including road foremen, to follow:

1—Make certain that the new employee is the right type of individual to take into the ranks.

2—Make certain that the new employee wants to follow railroading as a career and is not just looking for a job.

3—Offer suggestions to the new employee as to how he may better learn his work and the general operation of the railroad.

4—Set up an educational program that will make certain the new employee learns the fundamentals of the job undertaken.

5—Follow the new employee closely during the first months of his employment to make certain that he will not become a round peg in a square hole.

6—Point out his strong points as well as his weak points and assist him in overcoming the weak points.

7—Take the new employee into confidence and point out to him the reasons behind each request. Then, when it becomes necessary to ask for special effort or special duty, the new employee has sufficient confidence and respect to put forth his wholehearted cooperation.

8—After the new employee becomes an old employee, do not forget him, but periodically be with him, discuss his problems, the problems of the railroad, and other items of mutual interest. Let him know that he is still an individual and not merely a payroll number.

It is my belief that the "proper individual" can be trained to do practically any type of work or to accomplish any supervisory task for which he is selected. It does not follow that the only person qualified to instruct in the proper operation of a locomotive is a man who has been hired as a fireman, progressed through the ranks to an engineman, and then has been promoted to the position of road foreman. I shall concede that the "proper individual" with this background is better qualified to begin work as a road foreman than a like individual without this background. Within a short period of time, however, this distinction should rapidly disappear. It is my belief that when a man becomes a road foreman he has not reached the limit of his advancement. On the Atlantic Coast Line we have former road foremen as Diesel shop foremen, trainmasters, and assistant chiefs of motive power. On the other hand, we have a former electrical supervisor as assistant road foreman. Properly selected men in this capacity should have equal chance for advancement with those men from the ranks of supervisors in the shops. Here, I should again like to stress the importance of the individual.

In meeting present-day requirements of speed and service, the simple problem of transporting people or material from one point to another has become complex. How well each of these functions is performed is the criterion of success. As an example, I should like to cite a roadway department with the best prepared track structure, a dispatcher who has set up the best possible operation, a conductor who has been the most courteous and helpful individual in his contacts with the traveling public, equipment perfect in all respects; yet, an engine crew fails to find a blown fuse in a control circuit and causes a delay of several hours. The passenger judges the entire performance of all railroads by this one failure. This is also true with respect to freight shipments. A freight agent in accepting a shipment has performed his duties well and efficiently. A delivering agent has been most helpful in the delivery of the freight and in filing a claim. Yet, one moment of carelessness on the part of one yard crew has destroyed all the past good will built up with the shipper and receiver by mishandling the car and destroying the shipment. It is time that all employees and supervisors alike take stock of our individual efforts and the effect they are having upon the operations as a whole and ask himself this question, "Am I doing my part in contributing my full effort to the whole operation?"

Handling Long, Heavy Freight Trains

A description of braking practices to attain better starting, braking, and releasing under various operating conditions

Before attempting to start a long, heavy freight train, allow ample time for all brakes to release, and when starting, keep the locomotive at a slow and uniform speed for at least 200 ft. There is from 65 to 100 ft. of slack in a 100-car freight train, and to avoid damage to draft gears, couplers and lading, the locomotive speed must be slow until all cars have been started. With two locomotives ahead, the engineman of the lead locomotive should start the train unassisted, if possible. The engineman of the second locomotive should not assist in starting, unless, and until he receives a signal to do so.

If necessary to take the slack when starting, the slack should be taken on the entire train. If on an ascending grade, where the rear portion of train will roll back when taking slack, the better method is to bunch the slack during a reverse movement by using the train brakes. This is accomplished by using a light pulling throttle. Making a light initial reduction, and do not allow the locomotive brake to apply during the reverse movement. After allowing time for the brakes to apply on the rear cars, move the brake valve to running position for two or three seconds, and then back to lap position, repeating this operation until nearing the end of the stop. Complete the stop with the brake valve in running position. This is to prevent brakes from applying on the head cars with sufficient holding force to allow the rear cars to run-out and stretch the train. The brake application should be started as soon as the train is in motion. After completing the stop, make a full service reduction, and allow ample time for all brakes to release before attempting to move forward. A hand brake applied on the caboose will assist materially in bunching the slack when making the stop and holding the slack while releasing train brakes. If the grade is very steep, brakes should be applied before the train is started

W. R. Sugg,
Chairman

in reverse movement; then the brakes on the head cars are released, and the locomotive and head cars moved back against the rear cars while brakes are applied on the rear cars.

Service Braking*

Before changing the throttle setting of the steam locomotive, and with the throttle of the Diesel locomotive in Run 6 or less, move the automatic brake valve to lap position, and leave in that position a second or two to check brake pipe leakage. If excessive, move the brake valve to maintaining position when the desired reduction through leakage had been made. If there is no leakage, move the brake valve to first service position and make an initial reduction of from 5 to 7 lb. Do not allow the locomotive brake to apply during the initial reduction. To avoid higher brake cylinder pressure on the head than on the rear cars, due to a heavier brake pipe reduction on acccount of brake pipe gradient, and to allow slack to be stretched during the first stage of the brake application while the train speed is high and the brake cylinder pressure low, move the brake valve to running position for about two seconds to start a release of the brakes on the head cars where brake cylinder pressure is higher; then return the brake valve to lap position. When the brake valve is placed back in lap position, the brake pipe pressure will level off sufficiently to move the control valves on the head cars to quick-service position, and the quick-service limiting valve will insure a 10-lb. brake cylinder pressure on those cars, which will be about equal to the brake cylinder pressure developed on the rear cars where the brake pipe pressure was not as high as it was at the locomotive. After allowing time for the drop in brake pipe pressure due to the functioning of the quick service limiting valve, the brake valve may be placed in maintaining position, if desired, to prevent a further reduction in brake pipe pressure. If additional reductions are necessary to control speed, or to stop before overrunning the objective, each subsequent reduction should be less than the initial reduction, and an interval of at least fifteen seconds should be allowed between each reduction. The locomotive throttle should be reduced as the speed reduces, and when not less than 50 ft. in advance of stop, a Diesel locomotive throttle should be reduced to idle position and a steam locomotive throttle fully closed. Sand should be used during the last ten to twelve car lengths from the stop. When about 40 ft. from the stopping point, start a final reduction of from 6 to 8 lb., and be sure the locomotive brake is fully applied as the stop is completed. If the final reduction has been started too soon, and the equalizing piston is about to seat, closing the service exhaust, increase the reduction sufficiently to have the exhaust port open, discharging the brake pipe air when the stop is made.

Release While in Motion

When it is desired to make a running release, start brake application as outlined under *Service Braking*. Then allow the brake pipe pressure to be reduced 2 or 3 lb. at a time by leakage, or if no leakage, make subsequent reductions of 2 or 3 lb. each until the desired reduction in both speed and brake pipe pressure has been made. The brake pipe reduction should be increased to at least 12 lb. on trains of 75 cars and to 15 lb. on trains of 100 cars before releasing. If speed is above 25 m.p.h., the throttle of the Diesel locomotive should be reduced to Run 3 or less when releasing, and if the speed is below 25 m.p.h. the throttle should be placed in Run 1. The throttle of a steam locomotive should be handled in such a manner as to reduce the pulling power of the locomotive during the release. Release with the brake valve in running position if the locomotive is equipped with a high-capacity feed valve.

When making a running release, if the speed has reduced below that desired, and continues to reduce, indicating brakes not releasing, the Diesel throttle should be placed in idle position and the steam locomotive throttle closed, and retarding force provided on the head portion of the train by applying the locomotive brake. If it is found the train brakes are not releasing and the train is going to stop, make a final reduction as outlined under the subject *Service Braking*. Be sure the service exhaust is open and discharging brake pipe air as the stop is completed.

The release of brakes on freight trains without liability of damage before a stop is made depends on the speed and length of the train, the degree of brake application, the position of the slack, the way grade conditions favor release, the amount of main reservoir pressure available, and the amount of brake pipe leakage.

When stopping a train, or cars, that are being pushed, such as in a reverse movement, make a light initial reduction, using a light pulling throttle, and keep the locomotive brake released throughout the movement. Do not make a final reduction as the stop is completed. To do so would cause the head cars to brake more heavily than the rear cars, hence a run-out of slack and the possibility of a break-in-two. Instead of making a final reduction, it is better to move the brake valve from lap position to running and back to lap two or three times during this movement, leaving the brake valve in running position during the last twenty or thirty feet of the stop. This is to prevent heavy loads on the rear of the train from running out, damaging couplers as the stop is completed.

Train-Service Application

When the brake is applied in service application on the train by other than the engineman, he will continue to use some power, reducing power as speed reduces, leaving the automatic brake valve in running position until the stop is completed. When not less than 100 ft. before the train comes to a stop, place the Diesel throttle in idle position, or close the steam locomotive throttle fully, apply the locomotive brake with the independent brake valve, and start sand running. After the stop has been made, make a full service brake application before proceeding.

Train-Emergency Application

If the brake is applied in emergency on the train by other than the engineman, he will place the automatic brake valve in lap position, close the steam locomotive throttle, or reduce a Diesel

* This section of the report was removed from the body of the report to an appendix by action of the Executive Committee. See the discussion.

locomotive throttle to idle position, and start sand running immediately. If operating a locomotive having the No. 8-A distributing valve, and the controlled emergency valve is set for controlled build-up of locomotive brake cylinder pressure, it is possible that the stop will be completed before sufficient brake cylinder pressure has developed on the locomotive to give the desired holding force, hence the possibility of a break-in-two. Therefore, when within 100 ft. of the stopping point, move the independent brake valve to quick-application position, and hold in this position until the stop is completed. With the independent brake valve in quick-application position, the controlled emergency valve will move to non-controlled position, closing communication to the application chamber, and develop a rapid build-up of application-cylinder, and in turn, brake-cylinder pressure. If the independent brake valve is not held in quick-application position, the return spring will force it back to slow-application position, and in this position the controlled emergency valve will move back to controlled position. In controlled position commmunication is established between the application chamber and application cylinder, allowing the higher application cylinder pressure to flow to the application chamber, thereby reducing application-cylinder pressure, and in turn brake-cylinder pressure at or near the end of the stop, resulting in severe strain on draft gears and the liability of a break-in-two.

Overcharged Train Line

Erratic operation of the feed valve, or a leaky charging valve in the No. 8 equipment, will cause an overcharged train line. Should the train line become overcharged when operating locomotive equipped with SD or ADA compressor governors, place the brake valve in release position and continue to a terminal, or point where the condition can be corrected, without a delay. If operating a Diesel locomotive, or a motor car, which is equipped with a type of compressor governor that allows approximately 10 lb. variation in main reservoir pressures, the brake valve cannot be operated in release position. To avoid a delay, place the brake valve in maintaining position, and proceed to a terminal, or point where the condition can be corrected. The engineman must take necessary precautions to prevent the locomotive brake from creeping on when operating with the brake valve in release or maintaining position.

When the condition that caused the overcharged brake system has been corrected, and it is desired to reduce to the standard pressure, make a full service reduction, and allow ample time for all brakes to apply fully. Then restore brake pipe pressure to within 10 lb. of the pressure to which it had been overcharged, and maintain brake pipe pressure to within 10-lb. from that reduced, and allow ample time for the brakes to release. Repeat this operation until pressure has been reduced 20 lb. below the standard pressure for that train. Then release with the brake valve in running position. It must be known that all brakes release before proceeding. Do not attempt to get rid of an overcharge while a train is running, except by usual application and releases at high speeds, or on grades.

[This paper was prepared by F. T. McClure, supervisor air brakes, Atchison, Topeka & Santa Fe. It is part of the general report on air brakes prepared under the chairmanship of W. R. Sugg, general supervisor air brakes and lubrication, Missouri Pacific.—Editor.]

Discussion

Serious discussion was raised to the service braking provision for releasing the brake by successive movements of the brake-valve handle to running position and back to lap and not using the release position. It was voted by the meeting to return the report to the Executive Committee for further consideration or withdrawal. After considering the matter, the executive committee reported its decision that the controversial features in the service braking section be removed from the body of the paper when it is printed in the proceedings and placed in an appendix for further consideration, and that all discussion on the subject be printed.

The Reduction of Objectionable Smoke

Factors involved in reducing smoke analyzed and the design, installation and operation of various aids to combustion described — Responsibilities of operating personnel discussed

While smoke is the result of incomplete combustion, and will be entirely absent only where combustion is brought about under the most favorable conditions, the emission of objectionable

G. B. Curtis,
Chairman

smoke by a locomotive indicates either that it is being improperly fired, or that some mechanical defect exists—with some exceptions, of course, as to the grade of fuel being used.

Many cities have instituted action toward some method of smoke abatement, some of them having gone so far as to limit or ban services rendered by steam locomotives within certain limits. As long as coal-burning locomotives are in operation the railroads will be confronted with more and yet more drastic regulations for the abatement of the smoke nuisance. The time has come for the railroads to put forth every effort to control smoke, not only in districts where smoke is restricted by law, but throughout their entire territory. The ever increasing cost of fuel and the mounting complaints of smoke conditions by the public in cities, towns and rural districts have made the problem of smoke abatement a major issue with the railroads.

Evils of the Smoke Nuisance

There are many evils chargeable to the smoke nuisance, chief among which is the effect upon the health of the nation. An authority on this subject states that "by banishing the preventable smoke in America, the nation's death rate would be reduced by one sixth; cities would bask in twenty to fifty per cent more sunshine; and the nation's fuel bill would be slashed one fifth." From another source the estimated damage caused by smoke in the United States alone is set at two and one half billion dollars. Approximately one and one half million of this is spent for washing, dry cleaning, painting and repairs to buildings; another two hundred million in fuel wastage, due to the incomplete combustion; and the greater part of the remainder for doctor bills in the treatment of infected eyes, ears, lungs, etc.

Smoke abatement and fuel conservation go hand in hand. There are a number of factors that enter into this problem, and every one concerned with the movements of trains and the furnishing of power to handle trains, has a responsibility for the elimination of objectionable smoke and the conservation of fuel.

Factors in Reducing Smoke

The first step in the elimination or reduction of smoke by the railroad companies should be in the design of the locomotive. It should be designed with sufficient heating surface and grate area so that the burning rate per square foot of grate area will not be too high. The locomotive of twenty to thirty years ago was not designed with sufficient grate area to burn coal slowly enough to permit proper combustion. With the increased cost of fuel locomotive designers have given this factor more consideration, and it is now a recognized fact that when coal is to be burned faster than 100 lb. per sq. ft. of grate area per hr., we are getting close to the point where smoke is most likely to be made.

Next in importance to the design of the locomotive is the care and attention it receives. In a paper, "Locomotive Fuel," read before the motive power committee of Bituminous Coal Research, the chairman of the executive committee of the large coal company said: "If a modern steam locomotive were given half the prompt care, half the expert attention, half the opportunity to work, that is given the Diesel, it would really have some records." That is to say that the service rendered on the road by the locomotive is dependent upon the service rendered in the enginehouse to the locomotive. Only when the enginehouse service is up to standard can standard efficiency be maintained on the road. This service should include daily inspection to see that there are no leaks in the firebox, to see that the flues and front ends are clean, that the arches are in good condition and of the proper height, and sealed or put down tight against the back flue sheet. Another important factor is the use of coal of standard size and grade, or as near to standard as can be obtained.

Aids to Combustion

As an aid to the elimination or reduction of objectionable smoke the locomotive should be equipped with overfire steam air-jet induction tubes or other devices used to aid combustion to help supply necessary air to the combustion area at times when the proper amount of air is not being drawn through the grates.

For the past several years a number of railroads have been experimenting with methods for getting extra air into the firebox to aid combustion when sufficient air could not be drawn through the grates. Some of the railroads have for years used the overfire steam air-jet induction tubes, but they were so noisy that the crews would not use them to any advantage. More recently Bituminous Coal Research has been conducting experiments at the Battelle Memorial Institute and on several railroads to eliminate objectionable noise made by the steam induction tubes. As a result several types of silencers have been developed which have been successful in part, at least, in reducing the noise made by the jets. Other roads have used air induction tubes in the sides of the firebox without the steam jets, but this did not prove to be of material advantage as the air drawn in over the top of the firebed did not penetrate very far into the combustion area. Hence the steam air jet was applied in the tubes to drive the air farther into the combustion area. The steam jet also creates a turbulence, or cyclonic effect, in the gas or combustion area that is considered to be an advantage in retaining the gases in this area until they are consumed.

Unless the proper amount of air is induced into the combustion area, and heated to the proper temperature along with the fuel, proper combustion will not be attained. Hence smoke will be made. If a locomotive properly is drafted and the proper amount of coal fired in accordance with the demands on the boiler, sufficient air should be drawn through the grates and up through the firebed to insure proper combustion when working steam to handle normal tonnage. However, only a small percentage of the objectionable smoke is made under these conditions. From 75 to 90 per cent of the objectionable smoke is made while the locomotive is drifting or standing, while in charge of crews building up fires, or while being serviced by the mechanical forces.

The draft on the firebed created by the engine blower does not pull sufficient air through the firebed for complete combustion, particularly when it is necessary to raise steam on the boiler quickly. To overcome this condition, induction of air over the firebed has been introduced as an aid to overcoming this deficiency.

Overfire Induction Tube Installation

Second only in importance to the induction of air over the top of the firebed is the proper installation of the air jets. The induction tubes should be staggered so as not to come opposite each other, but should be placed in such a manner as to cover, as nearly as possible, the entire grate area. The most effective results from the overfire tubes have been obtained by making the operation of the jets automatic with the locomotive blower. When it is necessary to use the blower to any extent, the use of extra air over the firebed is also needed. By connecting a small pipe from the blower line to a Nalco or trip valve in the steam supply line between the turret and the steam jet, the steam jets will be operated by the trip valve when the locomotive blower is open as much as 15 to 25 lb. A manual valve should also be included so that the jets may be used when the blower is not used heavily enough to cause the trip valve to work, as in maintaining fires at station stops. This is done by locating a globe valve within easy reach of the fireman in a steam pipe which by-passes the trip valve. Advantage may be taken of the overfire tubes in the roundhouse for building fires in cold locomotives by making a pipe connection from the steam blower line to the jet line with a check valve and globe valve in the latter. With this arrangement the jets can be used from the house blower line by opening the globe valve.

Some railroads have made use of steam jets placed directly inside the firebox near the door and pointing to the area just under the arch. These steam jets do not induce air, but they do create a turbulence in the gas area under the arch. There is also a device known as the "Clam Shell," or air jet, which is helpful in building up fires in the roundhouse on locomotives not equipped with any other form of jet. The device comprises a small piece of cast iron, forged in the shape of a clam shell, with an air-pipe connection. It may be coupled to the air line in the roundhouse or to the main reservoir on the locomotive.

Another device, known as the Mansfield Ashpan Air Distributor, according to dynamometer car tests, has proved very effective in reducing the stack loss, in smoke elimination, and in the conservation of fuel. This device consists of a series of baffles placed in the ashpan at right angles to the mud ring on each side of the ashpan to aid in distributing properly the air under the grates when the locomotive is running at high speed.

Locomotive Firing Conditions

A locomotive is fired under conditions different from those attending the firing of any other form of boiler. Some locomotives consume as much as nine tons of coal per hour. The fireman is continually changing due to seniority rights and business fluctuations, and firing practices change with the various services. In the average industrial boiler room there is very little change in the personnel, and the load changes are not as radical as those of a locomotive. The fireman on a locomotive builds his fire up on the ready track in such a manner that the train can be handled from the terminal without excessive smoke. Traffic conditions may develop which result in the train being delayed. To meet this condition the fire will have to be kept in condition to handle the train on short notice, and this sometimes results in smoke being made. None of these conditions enter into the firing of other industrial boilers.

For a successful, smokeless and efficient trip, the locomotive should be properly prepared for the run by the roundhouse forces, and it should be known that the locomotive is in proper condition with a reasonably well coked fire in the firebox when it is set out for the crew. The crew, on taking charge, should not get the firebed in a high state of burning until just before the train is ready to leave if there is sufficient steam and fire in the locomotive to take it to its train; by the time the train is to start the fire should be put in proper condition to meet all demands on the boiler in starting the train without having to add coal to the firebed at an excessive rate until the firebox temperatures

are up. The water level should be maintained as high in the boiler as conditions will permit so that the injector or pump will not have to be started immediately on starting the locomotive.

The Role of Personnel

Regardless of the overfire steam air-jet induction tube, or any appliance that may be added to the locomotive to aid in the elimination or reduction of objectionable smoke, nothing can be of material assistance unless crews and firebuilders are trained in their operation and use proper judgment in building and maintaining the fire. A good fireman watches his stack closely, observes the speed of the stoker and, on approaching points where the throttle is to be closed, stops firing far enough in advance to keep the smoke at a minimum and the safety valves closed. However, a clear stack is not the sole responsibility of the fireman. The engineman has his responsibility for working the locomotive at the proper cut-off, and in the proper use of water pumps and injectors.

Everyone concerned with the operation of the railroad has a responsibility in helping to reduce objectionable smoke to a minimum. After the roundhouse forces have set the locomotive out in proper condition, the yardmaster or train starter should not order the locomotive until its train is ready. All concerned should then work together to get the train under way as soon as possible. The train dispatcher is responsible for seeing that the train is not unnecessarily delayed, and that no unnecessary stops are made for meeting points or for other purposes. Local work should be assigned to as few trains as possible. The roadway department should endeavor to keep slow orders and bottle necks in traffic to a minimum. The track supervisor should avoid all stops that are not absolutely necessary, as each time the train is slowed down or stopped the chances for making objectionable smoke are increased. The yardmaster is responsible for receiving the train at the end of its run, and he should see that the locomotive is detached from the train and turned over to the enginehouse force as speedily as possible.

In addition to these, every officer, every supervisor on the road is, or should be, a smoke inspector, whether at the terminal or on line of road; and it is his duty to take whatever steps are necessary, regardless of time or place, to correct excessive smoke conditions.

The members of the committee are G. B. Curtis (chairman), road foreman of engines, R. F. & P.; W. J. Tapp, superintendent fuel conservation, D. & R. G. W.; G. N. Joyce, assistant road foreman of engines, A. C. L.; H. S. Flippen, road foreman of engines, A. C. L.; R. D Nicholson, road foreman of engines, N. Y., N. H. & H.; O. D. Teeter, fuel supervisor, D. & R. G. W.; J. A. Sturdivant, road foreman of engines, A. C. L.; H. T. Clark, supervisor locomotive performance, B. & O.

Discussion

This report aroused an extended discussion, from the tenor of which it is evident that the pressure for smoke abatement is becoming widespread and severe. Some tendency to legislate steam locomotives out of city limits is becoming evident, a situation which was met in one case by organizing the railroads, which were assisted by the local Chamber of Commerce. The council was prevailed upon to leave to the railroads the matter of means by which they would meet the smoke requirements of the ordinance.

The necessity for smoke abatement no longer applies alone to the large cities, but is including smaller communities as well. In Massachusetts, it was pointed out, a state-wide smoke abatement law has been passed.

Experience of several railroads indicate the value of steam-jet air-induction tubes in reducing smoke violations. Other measures mentioned include the employment of sealed arches and proper training of firemen. In this connection, it was mentioned that most smoke violations are caused by experienced firemen and not by the new men. The despatcher is responsible for creating black smoke during firing-up periods by the demand for locomotives on short time. Smoke can be prevented only by having time to ignite the fire slowly.

The general view of the matter was that smoke abatement is not a job which can be accomplished alone by the engineman. Low volatile coal has been used effectively in terminals where strict local ordinances are in effect. Man failures, however, continue to be responsible for a considerable percentage of violations. Engine crews have been made smoke conscious by disciplinary action when they have grown careless. The effect of black smoke was summed up as a waste of fuel, a waste of money paid in fines, and a bad reputation with the public.

Front Ends, Grates, Arches and Ash Pans

An analysis of front ends, grates, arches and ash pans and the part each plays in attaining improved drafting conditions

Data contained in a paper entitled "Locomotive Drafting and Its Relation to Fuel Consumption" which was presented in 1912 by H. B. McFarland showed that as much cylinder horsepower development is used to produce draft as to produce drawbar horsepower in a heavily worked locomotive. This paper brought forcibly to attention one of the greatest problems of fuel conservation in steam locomotive operation.

In 1933 a bulletin on the locomotive front end by Professor E. G. Young was published by the University of Illinois. This bulletin contains data from tests conducted on a model locomotive front end to determine the most efficient combination of front end arrangement. It showed and indicated the best possible combinations of exhaust nozzles, stacks and front end arrangements. For the designer there could be no better source for information of this kind.

One of the significant facts shown by the University of Illinois bulletin is that considerable changes have not produced any great improvement in front end efficiency. The bulletin states: "The most important dimensions affecting draft performance within or in connection with the front end is the difference between the top of the nozzle and the top of the stack. Assuming that the stack height is as great as possible, the nozzle should be placed as low as possible in the front end. It is clear that not much is to be expected from most of the changes which are commonly made to increase draft with the exception of changes in nozzle diameter. Adjustments in the height above the nozzle and the flare of the stack base do not hold great promise except when made to accommodate certain of the special nozzles which offer some improvement. Stack changes, particularly in direction of increased diameter, are promising, especially if it is found that nozzle sizes may be increased as well."

Front Ends

Front ends in modern locomotives conform in principal to the master mechanic's, or standard type, front end in which the round exhaust nozzle with some modifications is generally used. Many roads are using what is called a "nettingless" front end, which offers some improvement in the flow of gases, but the principal advantage is that it eliminates troubles experienced with nettings stopping up, a problem to which no other satisfactory solution has been found. There is also the claim that the cost of maintenance is considerably less than the frequent replacement of nettings. There are various types of nettingless front ends, some a commercial and some developed by railroads.

There is considerable vacuum used in moving gases through the smokebox where the gases are turned abruptly through five

right angles. As this is a tremendous consumer of energy it is believed that streamlining the inside of the smokebox to reduce the resistance to the movement of these gases—for example, by making round instead of square corners—will materially improve the performance of locomotives.

The most important change in the front end affecting the draft is the discharge of steam through the nozzle as determined by the exhaust pressure. In the University of Illinois tests the difference in efficiency in the exhaust nozzles tested did not vary more than about 12 per cent. The pepper-box type, or four-ported exhaust nozzle, gave the best results under all combinations of front end arrangements because the four exhaust jets gave greater entrainment area without too much retardation of exhaust steam flow. The four-ported nozzle, similar in principal to the pepper-box type except that the exhaust discharge from each cylinder is separate from the other through two of the ports, was adopted as standard for all locomotives on the Santa Fe and has been giving satisfactory performance for many years. This type of nozzle was developed at a time when heavy drag freight tonnage was the rule. It entirely eliminated the heavy back pressure discharge at the point of exhaust release from one cylinder into the other cylinder at mid-stroke, which materially

S. R. Tilbury, Chairman

reduced the tractive force of a locomotive working at heavy capacity under about 20 miles per hour. Since freight trains no longer operate at speeds this low, except for short periods of time, this feature is no longer of any great advantage. However, this type of nozzle has proven very efficient under all working conditions.

Roads are operating with round exhaust tips, basket-bridge, multiple exhaust, and four separate exhaust pipes, all indicating quite a wide divergence of opinion as to the best way of producing a vacuum with the least amount of work. The New York Central, as a result of the Selkirk tests, found that it is difficult to estimate how the front end should be put together without actual steaming tests.

Not only does the front end have to produce draft, but it must be designed to keep the front end clean of cinders, prevent discharge of sparks that would cause a fire hazard, and have sufficient velocity in the discharge of the exhaust steam to lift the smoke and steam well above the cab where it will not interfere with clear vision of the roadway and signals. Some roads obtained effective results from extension or folding stacks. Extension stacks raise the smoke well above the cab, and improve steaming qualities to the extent that the exhaust nozzle opening can be increased about seven per cent.

Next in importance to front end design is proper and adequate maintenance. When a standard size opening for the exhaust nozzle on any class of locomotive has been adopted, it is usually the largest size consistent with good steaming that can be obtained when the locomotive has been turned out of the shop after general repairs. Later, when the locomotive has become mechanically worn out, it is necessary to reduce the size of the exhaust nozzle opening, but this procedure should not be followed without a plan for periodic inspections and definite maintenance requirements.

At any enginehouse, locomotives are held several hours for removing and reapplying the front end appliance and to renew superheater units or flues. This should be studied to try to produce a front end which can be removed as a whole with the least amount of man hours.

Some supervisory forces of locomotive operation and maintenance do not know the standard sizes of exhaust nozzle openings for the various classes of locomotives in their territory. In cases of poor steaming, too frequently the easy way of correction is followed; the exhaust nozzle opening is reduced with a bushing. Later when pressure tests and suitable repairs are made, and the trouble corrected, the matter of enlarging the exhaust nozzle to the proper size may be overlooked.

The 1926 proceedings have some photographs that show quite strikingly the extent to which front end air leaks may exist on locomotives in regular operation. The effect of these photographs did much to correct the condition of front end maintenance in regard to air leaks. The photographs showed locomotive front ends filled with water where the back ends of the flues were plugged with wooden plugs. The water poured out in streams where air leaks existed.

Grates

The 1926 committee on grates presented its findings on what was then known as the restricted type of grates. About the time of this report, many roads were adopting the restricted-type grates having hole sizes generally from ¾ in. to ½ in. with less than 25 per cent air openings. The general trend was toward a smaller air opening, and finally grates having 12 per cent air openings were accepted as common practice. The results have been satisfactory in many ways and have resulted in definite improvements in combustion and locomotive operation.

The Santa Fe was one of the first to adopt the round-hole table grates, finally fixing the percentage of air openings at about nine per cent with holes ½ in. in diameter. Various kinds of coal covering a wide range of territory from Illinois to New Mexico have been burned successfully on these grates without changing drafting arrangements, and tests have shown that a saving in fuel from five to seven per cent was attained with a reduction in cinder losses of about 35 per cent.

Certain commercial firms manufacturing a special type of finger grate called the tuyere type have adapted their designs to a reduced air opening. This reduction does not restrict the flow of air but distributes it more uniformly over the grate area without any necessity for increasing the intensity of the draft or for reducing the size of the exhaust nozzle to increase the draft.

To secure satisfactory performance from any type of grate, but particularly from the round-hole table grate, careful fitting is necessary to prevent large openings between grate bars. Proper connections must be made with the grate rods to prevent grates from moving to a partly opened position or staying level. This requires routine inspection and a regular maintenance plan.

Arches

The type of arch used is generally regulated by the design of the fire box, whether arch tubes, thermic syphons or circulator tubes are installed. Some roads require arches to be sealed against the flue sheet, while others have the arch set approximately 5½ in. away from the flue sheet. Advantages are claimed for both methods. In any event proper maintenance of the arches is an important consideration in attaining the high steaming efficiency.

Ash Pans

The design and construction of an ash pan depends largely upon the design and construction of the locomotive itself and the available space for application of the pan. Sufficient air opening should be provided to prevent any restrictions to the flow of air under the grates. Fourteen per cent of the grate area for air openings through the ash pans has been generally accepted as adequate.

There has been a lot of study recently of the air openings between the mud rings and the side of the ash pans, the interference in ash pan steam blower pipes, and placing these pipes where they will not interfere with the flow of air. The so-called Mansfield device to distribute the flow of air evenly over the grates has been tested as a rapidly moving locomotive is thought to create air pressure under the back of the grates.

Conclusion

More has been accomplished by improved boiler design and construction, with the general use of feedwater heaters, superheaters, improved valve gears and higher steam pressures in modern locomotives than with any particular or highly specialized draft appliances. The horsepower required to produce the necessary draft has been reduced from what was known to be as much as 50 per cent to less than 20 per cent.

Because of the trend toward Dieselization on many roads, the possibility of improved appliances on the conventional steam locomotives will, no doublt, receive less consideration from responsible officials in the future.

The members of the committee are S. R. Tilbury (chairman), fuel supervisor, A. T. & S. F.; W. E. Small, chief fuel supervisor, B. & M.; H. E. Green, fuel supervisor, N. P.; L. W. Withrow, C. & O.; H. L. Malette, Superheater Co.; A. A. Raymond, superintendent fuel and locomotive performance, N. Y. C.

What Size Coal for Locomotives?

Tests proposed to establish relationship between relative performances in stationary tests and in road operation

A capable combustion engineer in one of the large research organizations has called the attention of your Executive Committee to the fact that, although he has checked the proceedings for many years past, he fails to find a general agreement as to what

A. A. Raymond,
Chairman

is the best locomotive coal. There are individual suggestions, but apparently no general agreement.

In fact, the railroads have been using run-of-mine coal quite generally since they stopped burning wood in 1875. Meanwhile, stationery power plants, where efficiencies are daily checked, have abandoned run-of-mine almost entirely; industries, for instance, using scatter stokers, rigidly demand very little spread between the top and bottom size of coal. The magazines of the coal industry say: "Generally speaking, the cleaning of coal for steam markets has been forced upon the producers by the necessity of meeting competition of other producers and by the demands of the consumer for a better product. Uniformity in quality and sizing is especially important to the steam coal consumer.

"Faced with a higher fuel bill, the consumer will tend to be more keenly critical of the quality of the coal delivered to him. What he wants is optimum efficiency for his fuel dollar."

While industry has gone away from the run-of-mine coal, we find the railroads taking enormous quantities of it. It might be said that the railroads use 80 percent of all run-of-mine coal, which indicates very little change in the sizing of coal in the railroad industry since they started using that fuel.

The mines, meanwhile, have progressed from using human beings for hauling so-called "coal baskets" to the modern conveyor or to electric locomotives for hauling; and the railroads similarly have progressed from the Dewitt-Clinton, burning wood, at a top speed of possibly 20 m.p.h., to modern Niagaras capable of handling 18 cars at 80 M.P.H., and it seems reasonable to assume that such a locomotive will use fuel that the most up-to-date testing methods show gives maximum steaming capacity, faster acceleration, greater speed, fewer steam failures and, therefore, improved availability.

An engineering executive of one of the large coal companies says that, in his opinion, only 10 percent of the coal shipped to the railroads last year was the best available for railroad use. The railroads together spent 386 million dollars for coal last year. This expenditure, of course, warrants the most exact knowledge as to the effectiveness of different types of coal. Possibly the honeymoon years of coal of any kind or size for locomotive use are almost over, and something drastic must be done to improve the preparation of the coal for the railroads. We have not found a general agreement between the railroads and the coal industry which would indicate the coal size which the locomotive can use to best advantage from each coal district or mine, nor available facts on which to base the value of the optimum locomotive fuel size relative to that raw run-of-mine size from the same mine opening. The coal industry has begun to realize that the modern locomotive must have better fuel if it is to compete with modern locomotives burning competitive fuels. The tremendous tonnage required by the railroads and the tremendous investments which must be made by the coal companies to provide this tonnage at low cost would certainly seem to justify fuel policies which are based on some very substantial test data. High pressure interference from either industry which forces the acceptance of unsuitable quality or size will provide only temporary benefits in traffic or shipping relief.

Railroads agree that steam locomotives are greatly handicapped in meeting present motive power requirements because of inferior quality, lack of uniformily and the relatively high cost of coal.

Steam locomotives, in spite of their limitations in space and weight, have been remarkably flexible as mobile power plants. They have been required to burn all kinds of coal—surplus sizes, coals which are high or low volatile, high or low ash, high or low fusion.

There is available considerable data as to the value of different sizes and types of coal. Some of the data are quite general and other are from a stationary plant, where the data is very complete and valuable and yet represents a run of only 45 minutes with a brand new fire and where it frequently took some little time (with certain coals up to 45 minutes) getting the fire ready to make the test run. As stationary tests are much cheaper and more satisfactory to operate than road tests, it has been suggested that an attempt be made to run several road tests and then see if representative conditions can be set up and the test duplicated on the test plant, as to length of run and operating conditions, considering that a road test consists essentially of the following for each division: (a) picking up the load as train starts—no bed of ashes under the fire; (b) burning at maximum rate as the train is accelerated; (c) burning at one-half maximum rate to hold the speed after the train has reached maximum allowed speed; (d) stopping quickly as the train reaches a station stop or is slowed up by signals, etc.; (e) picking up fire to maximum rate of burning as resume full speed—a quick pick up; (f) same after shaking a little ash off the grates—with ash and few clinkers starting to develop; (g) detecting and burning out clinkers; (h) making necessary adjustments of the stoker jets to overcome steam cut condition of jet holes; (i) adjusting coal feed to consumption.

The stationary tests have shown a different efficiency of combustion, based on less or more B.t.u. per pound, and some

slight differences due to other basic coal quality differences; but these do not seem to make nearly as much difference in efficiency as the mechanical mixture of the coal—that is, to have lumps small enough to permit a full flow of air on all sides of them for the most intense burning, but large enough so they will not be blown off the grates and into the firebox by the tremendous rush of air through the grates.

Relation of Stationary Tests to Road Operation

Stationary tests give very valuable data, but can only be considered as preliminary to actual road tests. As some railroads are using coal mined from many of the different seams east of the Mississippi River, the tests would be rather extensive. The stationary test, then, would be used most extensively, as soon as a relation has been established between road operation and the plan of operation at the stationary plant.

It is not the thought that such a test would say that a railroad can only burn certain coal, but that figures will be developed to supplement present stationary-plant figures, as to the additional horsepower it is possible to obtain from locomotives with properly sized coal, as compared—say, to a 4-in. resultant—so that for a road trip it can be shown what the improved performance, better loading of train, and the relative operating cost of different mechanical sizes of coal can be, and thus obtain more definite purchasing information.

In doing a modern job the railroads must meet the irresistible public demand for new standards for stack emission of both smoke and fly ash. At a burning rate of 100 lb. per sq. ft. or grate per hour, the loss due to unburned carbon is 14 percent lower for the egg coal.

Recommendation

It is recommended that the Railway Fuel and Traveling Engineers' Association invite a group of railroads, coal and supply companies to cooperate in carrying out a series of road tests which would cost approximately $100,000; and if, say eight railroads, eight coal companies and four supply companies will cooperate in the effort, this would cost each of them approximately $5,000.

This report was prepared by a committee of which A. A. Raymond, superintendent fuel and locomotive performance, New York Central System, is chairman.

Discussion

S. A. Dickson, transportation assistant, Gulf, Mobile & Ohio, questioned the answer to what is the best coal. He thought that the No. 1 coal for a railroad is that with which optimum results can be secured, and that these results are measured in dollars and cents and not B.t.u.'s. Ninety-five per cent of the problem, he said, is proper cleaning of the coal.

A. O. Geertz, fuel engineer, Pennsylvania System questioned the use of coal of closely uniform size on the stoker, and asked if better distribution over the grate were not obtained if the coal were of varied size. Test-plant results, he said, indicated that it is difficult to burn as good a fire with closely sized coal as with run-of-mine.

Glenn Warner, fuel supervisor, Chesapeake & Ohio, Pere Marquette district, said that the same situation with respect to coal existed now as after World War I; the choice of coal is very limited. This, he said, will continue until the supply exceeds the demand. Then the poorer mines will gradually drop out, leaving those with good cleaning plants.

On the New York Central 2-in. by 4-in. double-screened coal can be fed properly by jet adjustment and was said to be better than run-of-mine. When such coal finally reaches the firebox, some fines have been produced by the mechanical action of the coal during the loading process and by the action of the stoker feed.

Separate Steam and Diesel Fuel Reports

Increasing use of Diesel power shows the necessity of fuel statistics that are truly representative

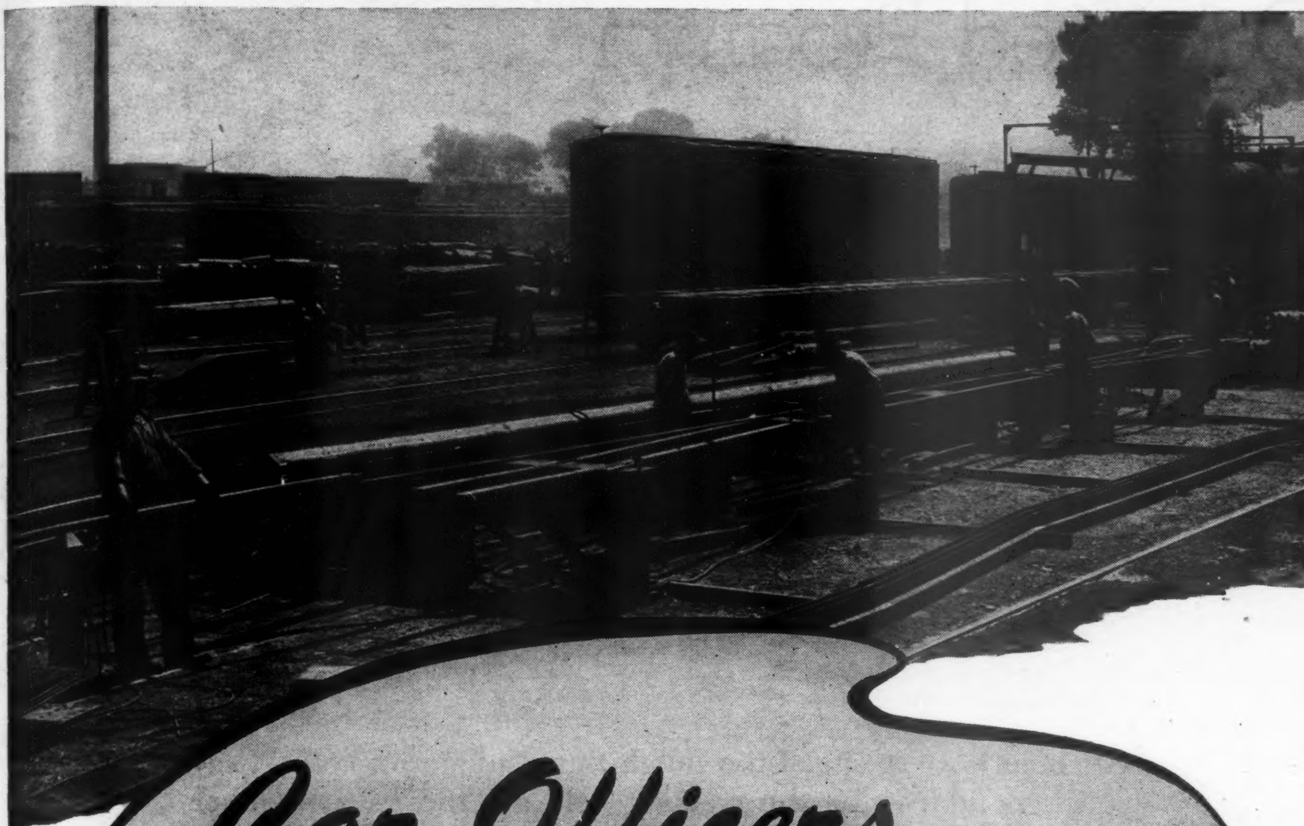
The Committee of Fuel Statistics has never been quite satisfied with the regularly issued fuel reports because, where coal-burners and Diesels are both used, a conversion factor has to be used to change gallons of Diesel fuel to pounds of coal. The wide difference in such conversion factors among the railroads, probably better than any other statement, illustrates the widely different viewpoints of practical operating men as to how many gallons of oil are equivalent to a ton of coal. However, outside of suggesting a change in the factor and so far as possible the acceptance of a factor fairly comparable on the different railroads, the committee thought it advisable to continue a single fuel-performance report.

Now the Diesels are handling an increasing proportion of railroad business; and, at the request of the Fuel Association, J. H. Parmelee, vice president, and director of the Bureau of Railway Economics, Association of American Railroads, Washington, D. C., has been printing a yearly report, separating the performance of coal-burners, electric locomotives, locomotives using fuel oil, Diesel, and gasoline-operated locomotives. This is taken from the current reports of the railroads to the I. C. C. and shows not only the total performance but the unit performance. In view of this general situation, the Committee on Statistics thought it advisable to examine the fuel-performance reports again to see, first, if a single informative report is practical, or whether it would take at least two separate reports to show just what the fuel consumption is in the operation of Diesels and coal-burners.

The committee finds that all railroads are separating passenger-car miles and gross-ton miles, etc., between coal-burners and Diesels. We have been unable to find any instructions which have required that these two reports be put together. Further, the committee suggests that, when these two reports are put together and show a combined unit performance, the figure does not mean much to anyone. It is not a figure that can be used readily to determine the unit fuel performance or the trend. Because of the basic interest of the Railway Fuel and Traveling Engineers' Association in whether the unit coal performance shows an increase or a decrease, and how much fuel oil it takes, say, for 1,000 gross ton miles and whether this is increasing or decreasing, it seems essential that two basic reports be made, one covering all coal-burning engines, and the other all Diesel locomotives.

The basic figures are set up for this type of report and it is the most informative basic report that the committee knows of. They therefore suggest that the Railway Fuel and Traveling Engineers' Association go on record that, for most intelligent handling and for best basic statistics, these reports be currently issued as two separate reports.

The members of the committee who submitted this report are: A. A. Raymond (chairman), superintendent, fuel and locomotive performance, New York Central System; P. E. Buettell, assistant supervisor, fuel and water service, Chicago, Milwaukee, St. Paul & Pacific; J. G. Crawford, fuel engineer, Chicago, Burlington & Quincy; H. Morris, superintendent, fuel and locomotive performance, Central of New Jersey; W. E. Sample, superintendent, fuel conservation, Baltimore & Ohio System; E. G. Sanders, fuel conservation engineer, Atchison, Topeka & Santa Fe; W. R. Sugg, general supervisor, air brakes and lubrication, Missouri Pacific; R. J. Tucker, assistant fuel supervisor, Chesapeake & Ohio.



Car Officers Study Maintenance Methods

Reports and Addresses at the Meeting

* A Responsibility of the Car Department
* Car Officers' Obstacles and Opportunities
* Passenger Car Painting and Its Maintenance
* A. A. R. Interchange and Billing Rules
* The Causes of Equipment Failures
* Report on A. A. R. Loading Rules

Passenger Car Truck Maintenance

Car Department Automotive Equipment

Car Lubrication Practices

* *Reports and address indicated by asterisk appear in this section.*

Balanced Program at Car Officers' Meeting

G. R. Andersen
President

Car men have to spend too much time "plugging holes", say speakers addressing the meeting held at Chicago September 15 to 18, inclusive—Eight reports presented and discussed

PREVENTIVE maintenance, instead of repairs after failures occur, was strongly advocated by both L. L. White, operating vice president, C. & N. W., and K. F. Nystrom, chief mechanical officer, C. M. St. P. & P., in addresses at the 36th annual convention of the Car Department Officers' Association, which was held September 15 to 18 inclusive, at the Hotel Sherman, Chicago. In Mr. Nystrom's discussion of the subject, he made the apt comment that railway car men have to spend too much time "plugging holes".

Other prominent speakers who made short addresses or were introduced at this meeting of approximately 350 railway car department officers and supervisors from all parts of the country, included V. R. Hawthorne, executive vice-chairman, A. A. R., Mechanical Division; R. V. Wright, editor, *Railway Mechanical Engineer*, Past-President F. E. Cheshire, operating vice-president, Monon; and F. L. Kartheiser, assistant to vice-president, C. B. & Q. Committee reports were presented on the following subjetcs: Loading rules, interchange rules, car department automotive equipment, freight car for modern requirements, passenger-car truck maintenance, passenger-car painting and its maintenance, car lubrication practices, causes of equipment failures and an extemporaneous discussion of air-conditioning failures.

The meeting was presided over by President G. R. Andersen, superintendent car department, C. & N. W., who welcomed the members of the association and made the opening address. One of the most important features of the convention was the extensive exhibition of railway car devices and materials presented under the auspices of the Allied Railway Supply Association, Inc. Abstracts of individual addresses and committee reports will be presented in this and subsequent issues of *Railway Mechanical Engineer.*

At the concluding session of the association, the following new officers of the association were elected for the ensuing year: President I. M. Peters, secretary and superintendent, Crystal Car Line, Chicago; Vice-Presidents P. J. Hogan, supervisor, car inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn. —G. H. Wells, assistant to superintendent car department, Northern Pacific, St. Paul, Minn.—J. A. Deppe, superintendent car department, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.—J. D. Rezner, superintendent car department, Chicago, Burlington & Qunicy, Chicago. F. H. Stremmel, assistant to the secretary, A. A. R., Mechanical Division, Chicago, was re-elected secretary-treasurer of the association.

President Andersen's Address

"In calling the 36th annual convention of the Car Department Officers' Association to order I want to extend a most sincere welcome and hope that the papers to be presented and discussions to follow will be both interesting and instructive.

"For me to forecast that many present car problems will diminish in the immediate future would be extremely foolhardy for the reason that if the industry is to survive, fast and safe transportation of both passenger and freight trains must of necessity continue. The step-up in speed shortly after the war, while unquestionably necessary in order to compete with other forms of transportation, caught us somewhat in between. We were not entirely prepared. Conventional types of passenger cars were and are still being operated; freight cars adapted to 40-mile speeds were and are still bumping along at speeds from 60 to 85 miles an hour.

"Unquestionably, we are in a period that requires, and will require for sometime, the utmost in vigilance and

earnest application if failures are to be minimized, but perserverance in the direction of improvements in design and construction of both freight and passenger equipment will, along with simplicity in the rules under which we work, ultimately pay dividends.

"The necessity for discontinuing C. D. O. A. conventions during the years 1942 to 1945, inclusive, deprived the officers of annual contact with you and naturally affected the membership standing. As a matter of fact, had it not been for the commendable perseverance of such men as Jack Acworth, Al Krueger, Frank Cheshire and a few other close associates, it is entirely possible that the association would have discontinued its activities, at least temporarily. Further, what greatly influenced the officers to carry on was the encouragement and assurance on the part of V. R. Hawthorne, executive vice-chairman of the A. A. R. Mechanical Division. Contributing also, and in no small manner to the welfare and continued operation of the association, was the support given by the editorial staffs of the Railway Age and *Railway Mechanical Engineer* for which we are deeply grateful.

"On several of our standing committees, particularly the Booster and Reception committees, there are many representative supply men, and, as usual, they stood by and assisted your officers in every manner possible, and they are to be commended for their loyalty and comradeship. Committee personnel, particularly subject and membership, have, regardless of many obstacles, done a fine job and deserve our thanks. All to the end that your association is in good standing financially and at the moment has a railway membership of 1,128, and, in addition, approximately 140 supply companies holding membership.

"I want particularly to discuss committee work and hope that you will forgive me if I deal with the subject rather frankly. If we agree that the activity of mechanical associations, such as are meeting here this week, actually are a vital and living part of the railroad industry, and if we agree that the work done by these associations is actually accomplishing the result of better and more economical operation, which after all is their main purpose, then, we must come to a better understanding of the importance of committee activity.

"Frankly, the selection of chairmen and committees to handle the various subjects decided upon by the officers of these associations is getting to be quite a task. First, there is the job of getting the proper individual to serve as chairman. Invariably, he is a man of known ability in his field—holds a responsible position, and consequently the matter of time that he can devote to the assignment must be considered. Then, there is the matter of committee personnel, usually eight or ten, and believe me many a contact and many a letter is written before the committee is finally completed. Then, there is the matter of attendance at the meetings called by the chairman, and any one of you who have served, or are now chairmen, know what happens very often. After all, the foundation of this or any association is the product of the committees. There would be no membership—there would be no gatherings, such as this—there would be no exhibits—there would be no association at all if it were not for the work done by the committees.

"Seriously, we need more enthusiasm i nthis direction on the part of the members; we need all-out interest and support on the part of the railway officers; we need voluntary offers to serve on the committees; we need to get back to the days when many of us considered it an honor to serve on a committee, and actually it is an honor, for is it not in itself a recognition of your ability in your chosen field? It will more or less place you in the spotlight and assist in your future advancement and welfare.

"I am convinced that this association is on the threshold of greater accomplishments. It can be a powerful influence in bringing about changes in standards that are not in keeping with present-day operation. I solicit your continued interest and help in attaining this objective."

Car Department Officers' Association Officers 1945-46

President: ***G. R. Andersen, superintendent car department, Chicago & North Western, Chicago.***

Vice-President: ***I. M. Peters, secretary and superintendent, Crystal Car Lines, Chicago.***

Vice-President: ***P. J. Hogan, supervisor car inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.***

Vice-President: ***G. H. Wells, assistant to superintendent car department, Northern Pacific, St. Paul, Minn.***

Vice-President: ***J. A. Deppe, superintendent car department, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.***

Secretary-Treasurer: ***F. H. Stremmel, assistant to secretary, A. A. R., Mechanical Division.***

I. M. Peters

P. J. Hogan

G. H. Wells

J. A. Deppe

F. H. Stremmel

Air Conditioning Failures

At the request of President Andersen, the subject of air conditioning failures was considered briefly on the floor of the convention and the representative of one railroad said that over 300 such failures occurred in the month of July. These failures occurred in all types of equipment and he attributed them to short turn around time, lack of adequate trained help, excessively high temperatures experienced this summer, but primarily owing to inability to do an adequate amount of periodic overhaul work prior to the summer season.

Another member agreed with the foregoing statement and added that air-conditioning equipment is complex and little things can cause trouble and must be detected and corrected. He advocated appointment of a system supervisor of air-conditioning who can coordinate the work on the entire railroad assisted by enough local supervisors so that a competent man is available at each terminal point. The additional thought was advanced that air-conditioning supervisors in the field who ride trains in daily operation (possibly for only short distances on individual trains) will correct many conditions which cause failures and greatly improve air-conditioning service.

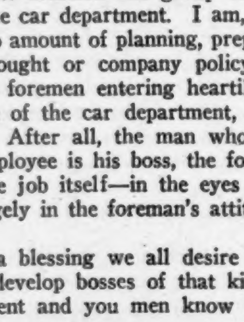
A Responsibility of the Car Department

By L. L. White

Vice-President, Chicago & North Western, Chicago

This gathering is, I think, quite representative of management and employes and while we are considering, among other things, the wholesome relationship between employer and employee we should not neglect to mention one group of men who are vital to the success of the car department. I am, of course, referring to the foremen. No amount of planning, preparation of rules and regulations, fore-thought or company policy can produce good results without the foremen entering heartily into the spirit of the general welfare of the car department, and with a burning desire to produce. After all, the man who means the car department to the employee is his boss, the foreman. In most instances, whether the job itself—in the eyes of the employee—is a good one lies largely in the foreman's attitude toward his men and his company.

A good boss is a blessing we all desire and the aim of the management is to develop bosses of that kind. We have them in the car department and you men know it. I am sure, too,



L. L. White

that it is not inappropriate to remind ourselves from time to time of our responsibilities toward them. It is to the foreman that the employee looks for guidance and direction in performing his daily job. Quantity and quality of production, as well as its cost—the factors which at least to some extent determine the wages we can afford to pay—depend in a great measure upon the foremen. It is also from the foreman that the employee gets his slant on both his immediate job and the company which employs him. It is within the foreman's power so to direct his men that they will not only know what they are doing and why, but will also want to do it well. Today the foreman is a leader of his men. The day of the driver or the strong-arm boss has given way to leadership which guides and inspires.

These are large responsibilities and the fact that the car department stands where it does today in production and in labor relations is indicative as much of the tact of the foremen as it is of the employees engaged in the business. No workman is likely to have the proper regard for his company or for the higher officials unless he respects and likes the foreman—his boss—and the foreman who takes the proper interest in the men under him plays an essential part not only in the management of the company but also in its success and prosperity.

Where Supervisors Come From

Where do these foremen, other sub-officials, officials and executives come from? I think you will agree with me that most of them originate at the bottom of the ladder and work their way up through successive promotions — providing they have learned to take orders before giving them, know how to lead men, and have the character, courage and ability to administer. Ambition is an important characteristic in mankind, providing management keeps the lines of promotion open so that the ambitious man can keep on climbing the ladder step by step as his ability warrants, and this constant movement of men upward is one reason why the car department has had, and continues to have, a fresh point of view. Someone is always bringing a new idea on up with him.

Most men of my acquaintanceship are endowed, I think, with a certain amount of ambition and it has been my experience that with a reasonable amount of effort on the part of the bosses this spark can be fanned into a burning desire for achievement. It is not my desire or intention to minimize the importance of the men of the car department either below or above the foremen. The safe movement of equipment depends, as we all know, to a large extent on the proper discharge of his responsibilities by every inspector, car repairer and oiler. These men, many of whom seldom work in groups under direct supervision but are often scattered through large train yards and other more or less inaccessible places, have been taught the meaning of responsibility and they are performing their daily tasks with great skill. I pay tribute to them and to you who, as their officers and supervisors, have trained them.

Car Supervisors' Responsibilities Classified

The responsibilities of the car department to the railroad can be classified under the following general headings:

Safety.—By this is meant safety for the traveling public, safety for employees, safety for the stock and goods of our shippers, and safety for our own equipment and fixed property.

Personnel Training.—One of the prime requisites of any department is that it must provide and train men to fill vacancies, take promotion, or to undertake new tasks.

Condition of Equipment.—This is related directly to safety in operation, but here I am thinking principally of furnishing properly conditioned cars for all purposes.

Modernization.—The car department must be alert to recognize the need for and to recommend changes in equipment, standards, plant, or methods where the economics of the situation warrant changes being made.

There are two million freight cars and thirty-eight thousand passenger cars now in service in the United States. Our car inspectors must decide when they are not safe for service. To make this decision they must be familiar with many types of construction and know where to look for defects. They must have a thorough knowledge of rules and standards established under the Safety Appliance Act, the Interchange Rules, and the Loading Rules. They should have keen eyes and be alert to detect any wear or weakness that may endanger the car and its contents. The car department is responsible for the performance of the inspectors and it is important that they be checked periodically and corrected or encouraged as the case may be.

I have been concerned by the number of occurrences of lading projecting or falling from open top cars en route, endangering other trains and causing unnecessary expense and delay. I strongly suspect that we should be able to put our finger on more of the weak spots and then prevail upon shippers to do a better job of blocking, or revise the loading rules where they appear to need strengthening. It is not intended to include open-top lumber in the above category, which, incidentally, is one of the most serious situations we have confronting us today so far as loading and blocking is concerned, because this matter is now under consideration by a special committee of your association. I do, however, urge that committee to vigorously progress the matter and stay with it until corrective action is taken. I know of cases where the same load has had to be set out and adjusted several times in a haul as short as 500 miles.

The car department must, within its limitations, furnish cars, both freight and passenger, suitable for the requirements of the lading, whether flour, coal, or passengers. Freight cars should be inspected thoroughly before and after loading to be sure that they will properly handle the load from shipper to consignee. Passenger cars are under closer observation than freight cars, but it is noted that complaints of lack of cleanliness frequently originate in other departments, or come direct from patrons, before corrective action is taken. In order to furnish suitable cars, it is of course necessary that an appraisal be made of existing ownership and requirements and a policy be established in respect to setting a limit of repair expense and a heavy repair program. A clear understanding of the importance of providing equipment which will not invite claims is necessary. Money paid out for claims is money that might have paid wages or gone into improvements. Great care should be exercised by those who recommend retirement of cars from further service; officers should be guided by a comprehensive study by the several interested departments. We must not throw away useful equipment, nor can we step out and buy new equipment prematurely. On the other hand, the time comes during the life of every piece of equipment when decisions must be made as to its future—whether to repair, rebuild, replace or retire. The car department must be able to guide these decisions with accurate data on expected life and repair costs, and informal opinion as to adequacy, obsolescence, et cetera. This organization and others of like character are important in the development of railroad officers' "know-how." It is at meetings of the type you have scheduled and in informal discussions with others who have similar problems and while examining the very fine exhibits on display here that new ideas are born or an interchange of ideas may occur. That the railroads recognize the value of such meetings is self-evident from the fine attendance mark that you are setting.

Hiring and Training Personnel

This brings us to the hiring and training of personnel. There has been a vast change in the art of car construction in recent years which requires a variety of special skills and understanding of many technical problems. We can no longer hire a boy, equip him with a hammer and packing iron and turn him loose as a car inspector. We should see that our employing officers carefully screen the applicants and hire those whose education, physical condition and attitude fit them for training for present day requirements. They should be given the opportunity to learn various skills and be assigned or shifted within the limits of the working agreements so as to broaden their general knowledge and increase their value to the company and their own potential earning power. They should be instructed both in the opportunities and the obligations of their job. The war period was responsible for relaxation of standards in selection and training of personnel, but the war is over and it behooves us to get busy and either improve the men who are not measuring up or, if necessary, assign them to less important work.

When it is considered that the past 20 years encompass the entire development period and almost universal acceptance for railroad equipment of such improvements as welded and alloy construction, streamlining, air-conditioning, electro-pneumatic brakes, fluorescent lighting, radio, train communication systems and other innovations developed to increase the value of the service we perform, it is obvious that there is need for competent supervision. Supervisors should have training in the mechanical and electrical branches of their field and they must have the valuable asset of knowing how to deal with employes under them. On the North Western we have for some time been conducting classes in both job relations and officer training. One of the purposes is to firmly establish a well-considered and uniform procedure in the handling of the problems that occur in the handling of men. Car departments with which I have been in closest contact have never been entirely free of job relations problems, and the responsibility is squarely on your shoulders to see that supervision is trained to quickly recognize these problems.

Some Comments on Modernization

With respect to modernization, the car department should counsel the executive officers on the necessity for improvements to existing or new equipment to meet the requirements of higher speeds and other changing conditions. They must accurately appraise the necessity of improved trucks, including roller bearings in freight service, and the economies of light-weight construction. These are only two examples of the counsel required in planning for our future. It should be recognized that our national economy is based on smaller inventories than in the past and a rapid turn-over demands a fast movement from producer to consumer. This must be considered in making our plans.

Modernization of plant is important. Shops and repair tracks must be efficient at today's high costs. It will pay dividends to study and effect necessary modernization of machinery, material handling equipment, roadways, and, in some instances, buildings.

Modernization of methods is the end result of careful planning, of analysis of employee suggestions, of the interchange of ideas, and effective team work between supervision and workmen. It pays big returns on a small investment in money but a large expenditure of effort.

Our reason for making the effort is to stay in business. We have obligations to meet and we have keen competition which threatens to absorb more of our potential income, as more super-highways are built and air travel becomes better safe-guarded. You, as an organization and as individuals, should devote as much time as possible to the solution of present day problems to the end that our car equipment may be almost continuously available for efficient operation.

I am happy to have been introduced by your able president, G. R. Andersen, whose regular job as you know is superintendent of the car department of the C. & N. W. I believe that it is a responsibility of the various railroads to permit or even assign certain employees and officers to participate in activities of this kind. That is why there are several North Western men on your program.

I am impressed with the usefulness of the activities of this organization and in reviewing your program I am glad to see that a number of the points that I have been able only to touch on are being discussed in detail by other speakers. These subjects are of common interest. You are performing a work which is of value to the railroad industry and I hope to see it continued and enlarged.

C. P. R. Converting Island Line to Diesel Power.—Plans for the complete conversion to Diesel-electric power of the Esquimault & Nanaimo on Vancouver Island have been announced by W. M. Neal, chairman and president of the Canadian Pacific, owner of the E. & N. The change from steam to Diesel-electric motive power will be made during 1948, the announcement said. Mr. Neal made this announcement while visiting Victoria, B. C., with a party of company directors on an inspection tour of the C.P.R.'s western lines.

Car Officers' Obstacles and Opportunities

By K. F. Nystrom

Chief Mechanical Officer, C. M. St. P. & P., Milwaukee, Wis.

At the turn of the nineteenth century a laborer's rate on the railroad was one dollar a day and now it is one dollar an hour. A box car could be bought for $600, the present cost being about $5,200. A passenger coach cost approximately $8,000 and now is well over $100,000. It was in this period, about 1900, that most present car department buildings were erected and, as labor was cheap, few if any labor-saving devices, such as cranes and other facilities, were provided. Structures built in that period were generally of brick with comparatively small

K. F. Nystrom

windows, and little attention was given to proper ventilation, sanitation, heat, light, etc. The size and weight of the freight and passenger cars of today could not be anticipated and, therefore, in many instances the equipment has outgrown the facilities the same as a child outgrows his clothes. This condition constitutes a major obstacle for efficient operation on many railroads.

As president of this association between 1930 and 1938, at the opening of the 1938 convention I made a statement that in the future 90 per cent or more of new equipment would be of all-welded construction and I further said, "I know quite well that many mechanical officers do not believe in welding and many other things, but not so long ago there were many who certainly didn't believe in steel cars. It was a new fangled idea and it was quite generally frowned upon. You cannot stop progress. Every modern industry, not only in this country but all over the world, has adopted welding. Large generators and turbines, about everything you can imagine, which a few years ago was built by riveting or casting, today is all welded. This is my view, my perspective. As an engineer I live in the future and with that point of view in mind I hope you will pardon these remarks if you do not agree with them."

The forecast made nine years ago is now a reality in that many railroads are now receiving all-welded freight and passenger cars and are ill-equipped to take care of them. This is another handicap which car department officers are facing at this particular time.

Poorly Equipped Car Repair Tracks

Many railroads have poorly equipped repair tracks. An up-to-date repair track, where the operation may not justify making repairs under cover but which employs ten or more men exclusive of train-yard inspectors, oilers, etc., should have the necessary buildings for office, locker and washroom for the men and storeroom to house all material except wheels, bolsters, trucksides, couplers and draft gears. A cement road between repair tracks should be provided for delivering jacks and other material including wheels, couplers, draft gears, etc., by means of lift trucks, direct to the car without any manual handling. Various types of efficient lift trucks are now available with necessary attachments for handling material; a truck driver alone, to illustrate, can take a pair of wheels from the wheel storage to the exact point of use, and pick up the condemned wheels from the repair track and return them to the scrap wheel storage. Needless to say, every repair track without exception should have a portable wheel-changing hoist and air-operated jacks for jacking loaded cars. A repair track should be wired for electric welding machines and, if a night shift is employed, efficient floodlights should be provided. If the average repair track is not provided with the above facilities, the supervisor works under considerable handicap.

Coach Yards Need Modern Equipment

Coach yard supervision on all railroads operating air-conditioned passenger cars and high-speed streamlined trains has seen in the last 15 years a radical change in passenger cars without being furnished, in most cases, the necessary modern facilities for servicing such equipment. Cars with high-speed trucks with roller bearings, air-conditioning equipment, heating system with thermostatic control, electric power generating system including fluorescent lights, and high-speed air brake with straight air, electrically controlled, require as much if not more expert attention than a steam or Diesel locomotive. Here again, most coach yards have outgrown themselves and in many instances it is almost impossible to find space for additional buildings to house the required facilities. Lack of adequate coach yard facilities is a real handicap and large sums of money are wasted when delicate repairs are of necessity often made in the open in all kinds of weather.

Another discouraging condition exists and that is that, outside of your association and some local car foremen's clubs, a car department officer can obtain but little information or assistance from outside sources in case of trouble. The Mechanical Division of the Association of American Railroads is practically confining its activities to legislative matters and apparently has little or no time for development or research.

To make the matter still more unsatisfactory, the locomotive and car department are, at a local point, often under one supervisor, who is generally elevated from the locomotive department. In my years of experience, I have never come across a supervisor who was equally competent in both locomotive and car matters. A supervisor trained in the locomotive department will naturally carry with him his first love, i. e., "locomotives," and will pay little attention to car matters. This is discouraging to a conscientious car department supervisor and it is hoped that all railroads will some day realize that the car department is fully as important as the locomotive department. I believe that the locomotive and car department should each have a superintendent who would report to a chief mechanical officer.

Car Officers' Opportunities

One of my doctor friends, at the age of 55, is discontinuing his practice of medicine as he is tired of "plugging holes" of people who come to him sick and worn out, and in most cases the patients have neglected themselves so long that they never can be restored to health and strength. Many car department officers are placed in the same position—just plugging holes by patching cars here and there without a systematic program, and this is particularly true of freight-train car repairs. Many railroads have no fixed repair program for freight cars but, instead, let the cars remain in service until heavy repairs or rebuilding is required. This is a wasteful practice and affords the car supervisor an opportunity to introduce a periodical, say 4-year, repair cycle which has proven not only practical but economical as well. By giving a whole series of cars general repairs systematically every four years, an efficient program

can be worked out by assigning particular series of cars to a given track or shop. This practice eliminates painting of cars between shopping periods and reduces the number of bad order cars to a minimum. With a well-planned repair program and retirement program which can be set up eight years in advance of the estimated retirement of a given series of cars, the number of unserviceable freight cars can be controlled and held between one and one and one-half percent. When cars are due for retirement because of their age and physical condition, the last cycle of general repairs should be carefully studied so that the car body, as a whole, will be worn out as uniformly as possible and after the cars have received their last general repairs, they are kept in service by giving them such light repairs as an ordinary repair track can perform without bringing the cars to a shop point, and in this way they are kept in service until they are finally unfit for further use.

Four-Year Cycle Repairs for Freight Cars

In addition to the 4-year general repair cycle for freight cars, an annual work schedule for system cars should be set up so that when cars come to the repair track all necessary attention is given at that time, at points where you are best equipped to do the work at a minimum of expense. This has particular reference to the repacking of boxes, draft gear inspection, reweighing and restencilling, cleaning of air brakes and other necessary work, so as to bring about a reduction in the number of times that the car will require movement to the repair track during the ensuing year.

A program as outlined above requires or calls for modern shop buildings and facilities, and it is a car department officer's plain duty to ask for these facilities. It has been my experience that the management is willing to spend money if it is assured of a substantial return on the investment. When a mechanic is paid $1.38 an hour, or more than two cents a minute, large sums of money can be saved if modern facilities are provided. When requests are made for improvements, we must be sure to estimate carefully and correctly the saving and above all make sure that the improvements are recommended at the right place so empty cars can be marked out of service without any back haul.

As I have previously pointed out, a car department officer is left pretty much to his own resources; consequently, here are unlimited opportunities particularly for young supervisors to display their talents and ingenuity. I wish to point out a few problems which must be solved if American railroads are going to maintain their place in the transportation field: There has been practically no improvement in wheel, axle and journal-box assembly in the last 100 years. The present journal-box bearing, wedge, dust guard and packing certainly reflect unfavorably on American ingenuity. This whole assembly should be redesigned to meet present requirements or replaced with roller bearings. In connection with roller bearings, two standard bearings and standard boxes should be designed, one for 50-ton and one for 70-ton cars which could be supplied by any reputable manufacturer.

Car Trucks Need Improvement

Both freight and passenger car trucks available at the present time are lacking many desirable features. The truck brake rigging, as generally used for freight and passenger cars, is crude to say the least. In this connection, some encouraging developments are now underway with regard to passenger truck brakes.

I do not believe that anyone can be happy about the foundation air brakes on all types of cars if first cost, weight and cost of maintenance are considered. The empty and load brake now on the horizon still further complicates the air brake system.

There are any number of parts and details in car construction which can and must be improved in the future but the problems mentioned should be sufficient to encourage supervisors to seek improvement both in practice and in parts.

I have endeavored to point out obstacles and opportunities facing car department officers for the purpose of demonstrating the vital part you men play in the proper functioning of the railroad with which you are connected. You are, or should be, directly responsible for operating ratios of about 6 per cent for freight, passenger and work equipment repairs, and when other car department maintenance accounts are considered, including depreciation and retirement, it can be assumed that the car department spends from 10 per cent to 12 per cent of the total railroad company's revenue.

A car department officer's manifold duties require him to be a versatile mechanic with thorough knowledge of all equipment and the operation of the railroad. He should know something about finance and accounting but, most important of all, he should be able to get along with his fellow men and be a leader of men.

To build up the car department to its rightful place on every railroad, young men with clean habits, good education, ambitious and willing to work early and late, must be selected.

It is indeed gratifying that your association stands for all I have tried to outline for you and there is no reason why the Car Department Officers' Association cannot be a powerful factor for the good of American railroads if you, as individual members, are progressive on your own railroad and as an association make determined effort to force through modern practices and new improvements for uniform adoption on American railroads. I trust these remarks will instill hope and a determination to forge ahead to new laurels for our respective railroads.

Passenger Car Painting and Its Maintenance

This report summarizes salient features of a subject too broad for detail coverage at a single meeting

Many new developments have taken place in the painting and maintaining of paint on passenger cars. At this time we feel the following are the most important.

The Mechanical Cleaning or Washing Machine

Being progressive paint men we believe these machines are a step forward in the cleaning of cars. We also think these machines are of value and with proper care, supervision and maintenance can be made to clean cars properly. However, it is the opinion of the Committee that at the present time, in most cases, the railroads are not obtaining the best results and in many instances are doing more harm than good to the finish. Our recommendations for improvement are:

(a) Better and more competent supervision of the mixing of solutions. By stating as we have—that more harm than good is done—we mean, that solutions have been applied too strong and harmed the finish and that when a comparatively new car is in line with one out in service a long period of time it is harmful to the newly finished car.

(b) More care and better facilities for the rinsing of cars. For example: In several instances acid has been found to remain on the cars after final rinse.

(c) That a competent man be designated to take tests of the solution at intervals for chemical analysis to determine whether or not there is a variation in the formula.

Terminal Car Painting

Our next important item, terminal car painting, or we might better say the lack of proper terminal car painting. It is our opinion that this part of railway painting has been abused, causing extra work in the shops when cars go in for refinishing. For example, in many instances panels are paint smeared over dirty

spots when cleaning would have eliminated the dirt and no painting required. This we feel is due to lack of competent supervision and not enough care in placing good mechanics on the job. In addition, proper tools are in many cases not provided, nor proper facilities made available for the care of brushes, storing of materials, etc.

Because of fast-drying qualities, lacquer is used in some cases for touching up over synthetic material, causing brush marks and necessitating removal of the lacquer before refinishing can be done.

H. E. Kneedler,
Chairman

We recommend use of a fast-drying synthetic material, where the original finish is synthetic, as it is in a majority of cases.

Up to this point we have mentioned the two things we feel to be of foremost importance for attention and investigation.

Next we take up some painting and cleaning schedules.

Painting Sandblasted Cars

Following sandblasting and cleaning, the first operation is to apply a coat of approved metal primer, taking care that all battons, rivet heads and crevices are filled in. This does not mean a heavy coat of primer, but a smooth, even coat, sufficient to form a good bond for the finishing coats. Ample time for primer to dry thoroughly is important.

Sandpaper the primer lightly and apply a coat of approved surfacer. Allow surfacer to dry thoroughly.

Putty all dents and holes and glaze rough and uneven spots. Any deep holes should receive a second coat of putty in order to build up the hole to a smooth surface. Allow time between coats for thorough drying.

Apply coat of surfacer over entire car and allow to dry thoroughly.

Glaze entire surface with knifing or glazing compound. Allow time to dry thoroughly.

Sand with Wet or Dry sandpaper, or stone rub to smooth even surface. Allow time for all moisture to evaporate.

Surface should be looked over and any bare spots touched up with primer and surfacer, allowing time between coats for proper drying. Care must be exercised in this operation not to leave any heavy edges around touched up spots. Light sand the touched-up spots and car is ready for enamel finish coats. If pyroxilin enamel is to be used, a coat of pyroxilin surfacer should be applied before final color coats.

Dust or wipe car thoroughly and spray thin coat of synthetic enamel. Allow to dry about one hour and spray a second coat of enamel. It is essential that the first coat be applied thin and evenly in order to prevent sags and orange-peel. Allow to dry overnight. This method of double-coating applies only to the modern synthetics, otherwise the materials should dry 8 to 10 hours between coats.

The next operation is to apply the third coat of enamel and allow to dry overnight.

Lettering and Striping

Now we come to the lettering and striping operations, and this depends on the method used. Where the spray stencil or masked letters are used, one operation as a rule is sufficient. First mist the letters over with a thin, even coat, and in 30 to 40 min. spray on a solid coat. Where the lettering pencil or brush is used it is necessary to allow enough time between coats to dry so that the undercoats will not soften and pull up with the pencil when the next coat is applied.

Where gold leaf is used for lettering a gold size is applied with a lettering pencil and after it has dried to the desired tack the leaf is laid either out of a book or gilding wheel. After the surplus gold has been wiped off the letters must be protected from abrasion with some kind of a transparent protective coating, to be determined by the master painter in charge.

Roofs and bottoms should be coated with an approved metal primer before applying metal protective paint or cement.

On new lightweight equipment, where the smoother light-weight metal side sheets are used, there is a possibility of buckling the sheets if sandblasted. A remover is recommended, either alkali or chemical. In either case all traces of remover must be removed before the primer is applied. Where the sheets are new, they should be degreased and disced in order to etch the metal to form a tooth for the primer. After the primer is thoroughly dry the same procedure should be followed as on the sandblasted surface.

Refinishing Over Old Surface

On cars where the surface is fairly good, no checking or cracking, but the finish has deteriorated to the extent that it requires a new paint job, the following schedule is recommended:

(a) Scrub the car thoroughly with a good car cleaner or soap, using a pulverized pumice stone or a like abrasive in order to dislodge grease and grime that have accumulated over the period of time that the car has been in service.

(b) Remove loose paint and putty, scale all rust spots, sandpaper the entire surface. Use a rust solvent and emery cloth to remove all possible signs of corrosion.

(c) Touch up with primer. Allow to dry, putty holes, putty and glaze, and if necessary spray surfacer on rough spots.

(d) Sand or rub putty and the resurfaced area.

(e) Spray coat of sealer or surfacer; however, if the surface is not too dry and has been well sanded enamel can be sprayed over the old finish.

Interior Painting

(a) Scrub thoroughly and rinse with clear water.

(b) Sandpaper the entire surface, preferably with water sandpaper.

(c) Touch up bare spots with primer. Allow time to dry.

(d) Putty and glaze where required. Allow time to dry.

(e) Sandpaper, putty and glaze. Apply coat of sealer, if necessary.

(f) Sandpaper sealer lightly and spray first coat of enamel.

(g) Spray second coat of enamel. If more than one color or shade is to be used, the section to be masked or protected should be dry before the application of masking tape or paper.

(h) Floors not to be painted should be covered to protect them from spray mist before the interior of the car is sprayed.

Interior Cleaning

The committee next discussed the methods of cleaning the interior of painted cars. As most of the colors used are semi-gloss enamel and dry to a rubbed effect lustre, they are harder to clean than a high gloss finish. Certain members of the committee reported good results from a wax-base cleaner, while others suggested a sprayed-on starch solution, which is then washed off, taking the dirt with it. However, the consensus of the committee was the use of a good soap and water.

Interior Finishing

The modern trend of interior finish has for some time been to color or a combination of color schemes, in two, three or more tones. There is very little we could add that would enlighten anyone familiar with modern railway equipment along these lines.

Most of you have had an opportunity to view the new streamlined trains and are familiar with the various color schemes. However, all trains are not of the new streamlined type and they do not have the face-lifting job of these modern Cinderella cars. The class of equipment most roads have overlooked in this trans-

formation period are coaches on short lines, local and commuter trains which carry a great number of revenue passengers. These cars could certainly be made more attractive to the riding public by the application of a two or three tone paint job, with possibly a change in upholstery. Light color combinations would add to the light of the car as well as to an attractive appearance.

In concluding, we have this to offer. Passenger equipment has to be well built to offer easy, quiet riding qualities, comfortable seats, overhead or individual lighting and air conditioning.

It is the province of the railroad and car building painter to now demonstrate his experience by adding to all the modern ideas which will help induce the traveling public to travel on the railroads. It will profit the railroads to consult their painters regarding color schemes to improve the appearance of equipment, as has been demonstrated by the new streamlined trains and last, but not least, to follow some of the suggestions for shop and terminal cleaning and painting, so that the passenger car finishes shall beautify and protect, thus adding to railroad income and help increase profit.

The report was signed by H. E. Kneedler (chairman), painter foreman, Chicago & Eastern Illinois, Danville, Ill.; R. Middleton, painter foreman, New York, Chicago & St. Louis, Chicago; W. J. Boltze, painter foreman, Pullman-Standard Car Mfg. Co., Chicago; D. Richmond, foreman painter, Pullman Company, Chicago; E. M. Driscoll, foreman painter, Chicago, Missouri, St. Paul & Pacific, Milwaukee, Wis.; H. P. Long, foreman painter, Chicago, Burlington & Quincy, Aurora, Ill.; J. S. Pritchard, foreman painter, Atchison, Topeka & Santa Fe, Topeka, Kan.; J. Thomisser, painter foreman, Chicago, Rock Island & Pacific, Chicago; J. M. Robertson, foreman painter, Grand Trunk Western, Port Huron, Mich.; P. J. Coolick, foreman painter, Delaware Lackawanna & Western, Kingsland, N. J.; R. G. Mudge, Thresher Varnish Company, Chicago; O. C. Hayward, president, Williams-Hayward Varnish Co., Summit, Ill.; L. A. Hartz, painter foreman, Illinois Central, Chicago.

Discussion

One member called attenton to the use of white lead in stenciling dates on freight cars and asked if there would be any objection to using yellow or other striking colors, such as are generally employed on passenger cars. The chairman replied that white lead is more durable and harder to obliterate but other colors may be used if desired.

The practice of touching up cars with paint at terminals was strongly condemned, especially when carelessly done over improperly cleaned surfaces, the result being excessive labor and material cost the next time the car goes to the system paint shop for general repairs where much of this terminal painting has to be cleaned off and done over again.

Inadequate terminal cleaning and painting is apparently due to the lack of adequate facilities and also time for a good job owing to the fact that modern streamlined trains particularly are turned so quickly at most terminals. One member said that the solution to this problem is better instruction and supervision of the men who do this work. He urged that a competent car cleaner mark all spots which require retouching.

The question of removing nicotine stains from around the holes in perforated ceiling panels was brought up and, after extensive discussion emphasizing the extreme difficulties involved, the following solution was suggested: (1) Clean the metal thoroughly with high-test naphtha; (2) roughen the surface thoroughly ether by light sand blasting or sand paper; (3) spray on a coat of surfacer and allow it to dry thoroughly; (4) lightly sand the surfaces with fine sandpaper; (5) apply two coats of enamel, allowing ample time for drying between coats. Following this procedure, the surface should be cleaned often with soap and water, or if longer periods are required between washing, the perforated panels should be wiped off with naphtha and the luster brought back by use of a cleaner.

(*The report was accepted.*)

A. A. R. Car Interchange and Billing Rules

The report presents numerous suggestions for proposed changes in the A. A. R. rules and the reasons for them

During the past year your committee has considered proposed revision of and additions to the present Code of A. A. R. Interchange Rules, and we submit the following recommendations for your approval and subsequent consideration by the A. A. R. Arbitration Committee.

The offer that this committee undertake the preliminary work of preparing an index of Passenger Car Rules, as contained in

C. A. Erickson,
Chairman

our report to the Association last year, was accepted by the A. of A. R. and we have, accordingly, compiled a proposed index (not included in this abstract of the committee's report).

The committee recommends revision in the Freight Car Index, as follows: Add Rule 94 to item covering "Betterments in repairs to foreign cars" and change this item to read:

Proposed Form: Betterments in repair. 17, 26, 70, 94, 95, 98, 104, 114, 120.

Reason: In order that the last sentence of the first paragraph of Rule 94 can be covered in the index.

Rule 9

Revise the fourth and fifth paragraphs in bracket opposite "wheels and axles, R. and R.," as follows:

Proposed Form: A. A. R. standard, A. A. R. alternate standard tubuluar or non-A. A. R. axle. Diameter of wheel seat. (Only one dimension for diameter of wheel seat to be given, which shall be the dimension nearest the condemning limit.) To justify scrapping of axles, show condemning dimension or other reason.

Reason: To facilitate the preparation of billing repair cards through elimination of useless information, thus, not only lessening the labor for write-up men but, also, effecting a reduction in the time consumed in the billing offices.

Rule 17

Modify section "L" of the Rule, as follows:

Proposed Form: Extra heavy pipe fittings may be substituted for single weight type, or vice versa, as correct repairs, and charge based on type of fittings applied, ***except that charge for nipples at angle cocks will be on basis of single weight pipe, and*** except for hand rails on tank cars where charge must be confined to single weight pipe and pipe fittings if standard to car.

Reason: In view of the requirements of Sec. (a-5) of Rule 3,

it is felt that charge for nipples applied at the angle cocks should be confined to single weight pipe.

Rule 17

Add new paragraph "R," as follows:

Proposed Form: When repairing metal running boards or metal brake steps, if defective parts are substituted with wood, or metal not car owner's standard, defect card for "Labor Only" shall be issued. In the case of handling line responsibility, defect card must cover both labor and material.

Reason: Rule 17 does not provide for any permissible substitutions when making repairs to metal running boards and metal brake steps.

Rule 23, Sec. B

Number the various items following the fourth paragraph of Sec. B. *Reason:* For better reference.

Truck Sides—Cast Steel

Modify the second sentence of requirements under this item, as follows:

Proposed Form: Welding of cracks or fractures *is prohibited, except in* the shaded area shown in Fig. 14 *and the* extending parts, as above mentioned.

Reasons: There is a considerable difference of opinion as to whether the sentence, as now worded, permits or prohibits welding of the extended parts, and our recommendation would leave no misunderstanding as to what we believe to be the intent.

Rule 23, Fig. 10

Delete all reference to reclammation of No. 2 Type—D coupler top-lock lifter.

Reason: No. 2 Type—D top-lock lifters have been in service for a considerable period of time and are developing wear at other surfaces than shown in Fig. 10. The committee feels such lifters should be scrapped and reclammation confined to the No. 3 lifter only.

In the event scrapping the No. 2 top-lock lifter is approved by the A. A. R., the phrase "which has not been converted to No. 3" should be deleted from Item 9 of Rule 19.

Rule 26

Delete this rule from the Interchange Rules.

Reason: Cars equipped with arch bar trucks are only interchangeable in switching areas; therefore, the committee feels that any replacement of arch bars which conforms to standard on car with respect to wheel base, center plate height, column guide clearances or not smaller in cross sectional area than standard to the car, should be satisfactory.

Rule 61

Your committee feels that some consideration should be given by the A. A. R. to develop some method whereby geared hand brakes which have been applied to cars can be lubricated without the necessity of removing the brake from the car.

Reason: The rule requires that the hand brake mechanism and connections must be inspected, tested and lubricated when cars are on repair track for cleaning of air brakes. The number of cars in service equipped with geared hand brakes which cannot be lubricated without removing them from the car is such that it is impractical to comply with the requirements of the rule, except in cases where it is necessary to R&R the brake on account being inoperative.

Rule 70

In our report last year, we indicated that the Committee would submit a proposed revision of the rule in this year's report. We feel that, in order to simplify the rule, it should be completely rewritten, and submit proposed form, as follows:

(a) When cars are not stenciled for type of wheels standard to car, cast-iron wheels shall be considered as standard.

(b) If double plate cast-iron wheels cast after 1920 are applied in place of any type of single plate cast-iron removed, or single plate non-bracketed cast-iron wheels are applied in place of single plate bracketed 700 or 750 lb. cast-iron wheels removed, charge for wheels applied must be confined to scrap value. A single plate and a double plate mounted on the same axle will be considered a pair of double plate wheels; a single plate non-bracketed and a single plate bracketed wheel mounted on the same axle will be considered a pair of single plate non-bracketed wheels. No defect card is required for such improper substitutions. (See Rule 98, Sec. (c-4) for charges and credits.)

(c) Substitutions To Be Considered Proper Repairs.

Stencil on car	Type Applied	Remarks
1. No stencil	1-W, 1WT, 2W or MW wrought-steel wheels	Charge for wheels must not exceed value of new cast-iron wheels (see also Notes 1 & 3 at foot of table.)
2. Cast-steel wheels	Cast-iron, 1-W, 1WT 2W or MW wrought-steel wheels	Charge value of wheels applied except that charge for new cast-iron wheels applied must be confined to secondhand value when repairing company is responsible for removal of wheels, and there is no owner's defect justifying their removal. (See also Note 2 at foot of table.)
3. Steel-tired wheels	1-W, 1WT, 2W or MW wrought-steel wheels	Charge value of wheels applied. (See also Note 2 at foot of table.)
4. 1-W wrought-steel wheels	2W or MW wrought-steel wheels	Charge for wheels applied must not exceed value of new 1W wrought-steel wheels. (See also Notes 1 & 3 at foot of table.)
5. Wrought-steel or 2W or MW wrought-steel wheels.	1-W, 1WT, 2W or MW wrought-steel wheels	Charge value of wheels applied. (See also Note 2 at foot of table.)

NOTE 1. When repairing company is responsible for the removal of wheels and there are no owner's defects justifying their removal from service, charge for wheels applied under items (1) and (4) must not exceed secondhand value of wheels standard to car. If the actual value of the wheels applied is less than secondhand value of wheels standard to car, credit must be allowed for the difference.

NOTE 2. When 1-W or 1 WT wheels are applied under items (2) (3) & (5) to passenger equipment cars, freight cars equipped for passenger service, or freight cars of over 70 ton nominal capacity, such applications are wrong repairs for which defect card must be issued. Charge for wheels applied must not exceed secondhand value.

NOTE 3. If, under items (1) & (4), 2W or MW wrought-steel wheels are removed which require turning to restore to full flange contour, and 2W or MW wrought-steel wheels with full flange contour are applied, labor charge of .7 hours per wheel for turning is proper, provided the maximum permissible charge for wheels applied is not exceeded. When 2W or MW wrought steel wheels are removed and same type applied, and bill is rendered for an amount greater than the value of wheels which car owner claims are standard to car, owner's exception must be supported by joint evidence.

(d) Substitutions Constituting Wrong Repairs for which Defect Card Must be Issued (Added to Note (2) Sec. (c)).

Stencil on car	Type Applied	Remarks
1. No stencil	Cast-steel or steel-tired wheels	Steel-tired wheels applied under items (1) (2) & (4) to be charged at scrap value. New or secondhand cast-iron wheels applied under items (3) & (4), and new or secondhand cast-steel wheels applied under items (1) (3) & (4), to be charged at secondhand value of cast-iron wheels.
2. Cast-steel wheels	Steel-tired wheels	
3. Steel-tired wheels	Cast-iron or cast-steel wheels	
4. Wrought-steel or 1W or 2W or MW wrought-steel wheels	Cast-iron, cast-steel, or steel-tired wheels	

Reason: To simplify and clarify the Rule.

NOTE:—If recommendation to revise Section (i), Rule 98 is approved, the reference to 1-WT wheels should be eliminated from proposed Rule 70.

Rule 94

Add new sentence to the second paragraph of the rule, as follows:

Proposed: Such bill should be rendered within two years of receipt of car home whether or not car has been actually dismantled.

Reason: The present Rule covers only time limit for repairs, and the addition, as recommended, would take care of cases where it has been decided to retire the unit from service but the actual dismantling is not performed within the two year period.

Rule 95—Par. 6

Revise requirements of this paragraph, as follows:

Proposed Form: When another type of coupler is applied in

place of missing Type "D," or when the "D" coupler (with all parts in good condition) is removed and replaced with another type coupler on account of renewal of defective coupler yoke, credit for coupler parts other than body is to be allowed on basis of prices in the *third* column of items 132 to 132-E, inclusive, of Rule 101.

Reason: Inasmuch as the third column of Rule 101 sets up an average credit for secondhand defective or missing parts, it is felt that this should apply in the case of coupler missing as well as when the Type D coupler is replaced by another type of coupler account defective yoke, as type "D" coupler parts, as a general rule, are more or less defective and require some reconditioning in order to make them serviceable for application.

Rule 98

Add new Par. 9 to Sec. (b) of the Rule, as follows:

Proposed Form: Axles removed which do not conform to limits for secondhand axles, as outlined in Rule 86(c), and which are not condemnable in service, will be credited as scrap at the expense of the line responsible for their removal. If owners and delivering line defects exist on the same axle, the delivering line will be responsible for expense of scrapping such axle.

Reason: To clarify what is believed to be the intent of the rule.

Rule 98

Combine Par. (c-4), (c-5) and revise the rule, as follows:

Proposed Form: (4) If, on basis of Rule 70 (c-1) or (c-2), improper substitution of cast-iron wheels is made, double plate cast-iron wheels and single plate non-bracketed cast-iron wheels, except 650-lb. single plate non-bracketed wheels, removed from service on account of owner's defects on mate wheel or axle which require dismounting, shall be credited as scrap, regardless of condition. Single plate 650-lb. non-bracketed wheels in condition for further service shall be credited at secondhand value. If removed on account of slid flat or damaged under Rule 32 conditions, double plate wheels shall be credited at scrap value. The same credit will be allowed car owner if, because of cut journal, both wheels are condemned account remount gauge or remount limits, or if one wheel is condemned and mate wheel is in good condition. Such wheels, if applied, shall be charged at scrap value.

Reason: In view of the prohibition to remount such wheels—Rule 69, it is believed that the proposed version will provide a more equitable basis for charges and credits.

If this recommendation is approved by the A. A. R., the present Par. (c-7) should be relocated and numbered (c-5).

Rule 98 (i)

In view of the fact that the present method of crediting and charging for other than new or secondhand 1-W wrought steel wheels, as provided for in Sec. (i) of the rule, was an emergency measure, your committee recommended in last year's report that the former method of classifying such wheels as "new," "secondhand" or "scrap" (determined by the service condemning or remount gauge limits) be reinstated. To the best of our knowledge, no action was taken on this recommendation and, after further consideration, your committee again recommends that the present method of calculating the value of such wheels be deleted and the former method reinstated in the rule.

Reason: The present method classifying such wheels results in a considerable amount of recording and detailed checking at wheel shop, creates delay in rendering of bills and additional work in the billing office. Further, checking by the committee indicates that there is very little, if any, economy in turning 1-W wrought steel wheels.

Rule 101

In the event the change, as recommended, in Rule 17, Sec. L, is adopted, the note preceding prices for extra heavy pipe fittings should be modified, as follows:

Proposed Form: Note: The following prices for extra heavy pipe fittings may be charged, regardless of kind of fittings removed, *except that train line nipples at angle cocks will be charged as single weight and* except for hand rails on tank cars where charge must be confined to single weight fittings if standard to car.

Rule 107

Add new note following Item 143, as follows:

Proposed Form: When running board end cleat or extension block is renewed separately, charge labor and material on bolt, lock nut and screw basis in addition to material charge for lumber.

Reason: Charge on lineal foot basis does not adequately compensate repairing road when these parts are renewed separately.

Rule 120

Revise the first paragraph of Sec. (g), as follows:

Proposed Form: If owner authorizes dismantling, handling line shall allow credit at A. A. R. secondhand value for wheels and axles in serviceable condition for reapplication under the rules, *except double plate and single plate non-bracketed cast-iron wheels.* Unserviceable wheels, *including double plate and single plate non-bracketed cast-iron wheels,* and axles and all journal bearings shall be credited at scrap prices shown in Rule 101. All other metal parts shall be credited at one-half cent per pound. From the total credit, deduct labor cost of dismantling, per Item 301 of Rule 107.

Reason: The road dismantling car should not be obligated to purchase wheels for which they will have no use at secondhand value.

P. C. Rule 8

Change last sentence, Item No. 15, to read as follows:

Proposed Form: Principle of notes following Sec. (*10*) of Freight Rule 32 applies:

Reason: On account of changing location of these Notes from section 11 to section 10 of the Freight Car Code.

P. C. Rule 18

Modify the second paragraph (immediately following notes to the first paragraph) so that it will definitely indicate just which paragraphs of Sec. A, Freight Rule 112 are referred to. If the paragraph, as now worded, is not intended to apply to all items covered by Sec. A, Freight Car Rule 112, we suggest that similar items be set up in P. C. Rule 18, as follows:

(1) The amount which handling line may charge the car owner for temporary or partial repairs to place car in condition to move home on its own wheels.
(2) The amount which owner will be required to pay the handling line in the event car is sent home loaded on another car and owner elects to dismantle the car.
(3) Method of determining salvage value.
(4) Arbitrary charge to cover cost of dismantling.

Reason: To clarify the intent of the rule.

Billing Repair Card

The present form, as shown on Page 281 of the 1947 Code of Interchange Rules, provides a column for weight of malleable iron castings. Very little use of this column is made by railroads, in view of which it is recommended that same be deleted, increasing space provided under the heading "Repairs Made."

The report was presented by C. A. Erickson (chairman), general A. A. R. inspector, Chicago & North Western, Chicago; D. E. Bell, A. A. R. instructor, Canadian National, Winnipeg, Man.; W. J. Burns, mechanical inspector, General American Transportation Corporation, Chicago; M. E. Fitzgerald, master car builder, Chicago & Eastern Illinois, Danville, Ill.; R. W. Hollon, mechanical inspector, Chicago, Burlington & Quincy, Chicago; C. W. Kimball, assistant supervisor car inspector, Southern, Atlanta, Ga.; L. J. Larrisey, chief A. A. R. inspector, Erie, Cleveland, Ohio; Frank McElroy, assistant to vice president, Union Tank Car Co., Chicago; J. J. Sheehan, supervisor car repair bills, Missouri Pacific, St. Louis, Mo.; F. Peronto, assistant to secretary, mechanical division, A. A. R., Chicago; C. R. Wiegmann, chief interchange inspector, Superintendents Association, St. Louis Interchange Bureau, East St. Louis, Ill.

Discussion

In the discussion of this report, the members voted to suggest one correction in Rule 70, Par. (d) referring to cast iron car

wheels. The phrase "Except as otherwise provided in Sec. (b)" was inserted ahead of the sentence beginning, "New or second-hand cast iron wheels applied under items in (3) and (4).

The members also voted to eliminate the changes suggested by the committee in Rule 95, Par. (6).

(*The report was accepted subject to these corrections.*)

The Causes of Equipment Failures

An analysis of some of the more important freight car parts which need attention to avoid service failures

Your committee has given serious consideration to the causes of railway equipment failures and after various meetings prepared an extensive report of which the following is a summary. We broke down the subject into eight parts, each member of the committee preparing a portion or one of the parts.

Safety Appliances.—While safety appliances are not directly the cause of equipment failures, yet we all fully realize that cars with defective safety appliances must be cut out of trains which necessarily retards the prompt movement of freight trains. You are familar with the common safety appliance violations. We urge that inspectors, supervisors and all concerned give this more serious thought.

Trucks.—Trucks are built in accordance with the requirements specified by the A. A. R. The design, of course, is primarily for the purpose of safe and easy riding service. Failure of truck parts contribute directly to delays, dissatisfied shippers and every effort possible should be made to detect defects in trucks and thereby bring about improvement.

Draft Gears and Parts.—Draft gears and yokes have been standardized on cars built new as well as in the re-building of cars. It is our opinion that serious thought be given to the gradual retirement of non-approved gears and yokes in older equipment. It is further our belief that the older type of couplers should be likewise gradually retired, including the Type—D.

Underframes.—We believe that most failures occur due to inferior construction, design, material deficiencies and old age of equipment as well as rough handling and overloading of equipment. It is our recommendation that practical consideration be given to retirement of old equipment. Of course, this can best be decided by each individual railroad or car owner.

Air Brakes, also Hand Brakes.—It is felt that while progress has been made in adopting the AB brake, there is much confusion and unnecessary delay which in many instances is caused by the AB brake equipment not being fully charged. Before cars are cut out of trains because of failure of air brakes to set, we believe additional brake applications should be made. Further, your committee desires to stress the importance of eliminating train pipe leakage. Also, when cars are on repair tracks, see that the piping is securely clamped and all of the associated air brake parts are in condition as they should be. We note with pleasure that a special A. A. R. committee has been selected to study again the brake beam problem, and we feel that much good will be obtained from that committee's work. On hand brakes we feel that there has been more or less neglect on the part of all of us. Some difficulty has been experienced in lubricating the geared type hand brake. The rules provide that that be done and we feel the manufacturers have not provided means for proper lubrication without the assembly being removed from the car.

Wheels and Journals.—Progress has been made in the manufacture of wheels to the extent that failures arising from this cause contribute to the total number of equipment failures to a lesser extent than formerly and there is still considerable room for improvement. You are familiar with the most common defects in cast iron wheels. Journal troubles are largely due to over heating. Badly-worn or broken box-equalizer seats, hollow box roofs, tilted boxes, wedges displaced, flat or otherwise out of gage contribute largely to hot box troubles, also the lack of oil, defects in the lining of the journal bearing, etc. Unsatisfactory arrangement of the box packing is another contributing factor.

Superstructure, Above Underframe.—In consideration of the older wooden-frame double-sheathed box cars, built many years ago, as well as some classes of single-sheathed steel superstructure box cars, there is no question but that these cars have served their purpose and that there is economy in carrying on a practical retirement program with this class of equipment. Referring to all-steel superstructure, it is felt by your committee that these cars should be cycled through for general repairs at least once every four years.

At this time we also call attention to the rough handling in train yards which greatly affects this situation. We find also that this equipment is suffering damage due to failure to protect the loads properly after being placed in the car. We think that is a problem for the transportation department to solve. In connection with automobile cars equipped with loading devices, we believe a more effective or permanent securement should be had to eliminate damage to racks and to provide that when these racks are properly raised to the roof, they may be properly secured.

Refrigerator cars of the older design are still a great bother to all of us. These cars should be eliminated as rapidly as possible. The all-steel refrigerator car seems to be performing satisfactory, and we urge that these cars be properly cleaned at unloading points to protect against contamination due to decayed vegetation, etc. On the open-top gondola car too much damage is occurring to the cars by those using clam shells or other types of loading or unloading devices. Many hopper cars of the older types in our judgment should be eliminated from service. On flat cars, our troubles mostly are floor damage. We suggest consideration be given to increasing the size of the floor boards, eliminate the tongue-and-groove or shiplap flooring, using only straight-face planking.

Switching, careless loading, freight house abuse and the abuse suffered to cars in industries is certainly an important factor when we consider the subject as a whole. The function of the car department is to inspect and keep cars repaired, and we generally have employees located at points where trains are made up or cars interchanged. However, at many outlying stations where there are no car department representatives, the judgment of placing equipment for loading is usually left to the local switch conductor and the loading is left more or less to the shipper. We strongly urge an organized campaign by transportation and operating officers for the general education of employees, both railroad and industrial, to load cars properly and thereby avoid damaging the equipment.

The report was signed by L. C. Geisel (chairman), district general car foreman, New York Central, Indianapolis, Ind.; M. J. Mills (vice-chairman), general car inspector, Pere Marquette, Grand Rapids, Mich.; C. O. Young, assistant superintendent car department, Illinois Central, Chicago; E. W. Gebhardt, district supervisor car maintenance, Chicago & North Western, Chicago; J. E. Keegan, chief car inspector, Pennsylvania, Chicago; E. U. Mazurette, superintendent car equipment, Grand Trunk Western, Battle Creek, Mich.; A. H. Petersen, superintendent car department, Belt Railway of Chicago, Chicago; M. E. Fitzgerald, master car builder, Chicago & Eastern Illinois, Danville, Ill.

Discussion

Brake rigging defects were said to cause from 75 to 100 failures per month, particularly in cold weather, at some terminals. One member said that worn-out brake beams, hangers and badly worn or improperly applied cotter keys are the principal defects and that this condition can be remedied by proper attention to brake rigging when trucks are sent to the repair track for other work.

A representatve of the Mexican railways reported that on the 10 deg. curves, common on some parts of his road, American freight cars become derailed owing to lack of flexibility in the truck design and particularly where it swivels on the body center casting. He stated that sometimes as many as 5 to 10 per cent of the cars are derailed due to this cause. More adequate lubrication of the center plates was suggested.

(*The report was accepted.*)

Report on A. A. R. Loading Rules

The committee suggests a practical means of securing data on loading conditions responsible for accidents

While your committee realizes that its principal assignment is to make recommendations to the A. A. R. Committee on Loading Rules for better loading, it has been agreed that it can do nothing better on this occasion than to indicate the kind of co-operation needed to assist the A. A. R. committee in convincing shippers that the reasons for proposing improved methods of loading are well founded.

F. A. Shoulty,
Chairman

In other words, we could make many recommendations for better loading, but deemed it best to first impress on your minds that doing so will be of little value until the railroads make greater efforts than they have in the past toward favoring the Association of American Railroads with enough information to make shippers understand and agree that they are to the best interest of all concerned, and to amplify this we, hereafter, quote some of the comments made by W. B. Moir, chairman of the A. A. R. Committee on Loading Rules, in his report at the Atlantic City annual meeting of the Mechanical Division in June 1947.

"Your committee, as you know, has devoted much time and effort in trying to meet up to expectations in providing safe loading regulations. Unfortunately, however, in too many cases your committee has been unable to furnish adequate data to the shippers regarding load failures and accidents to convince them that increased securement was necessary at increased cost, to provide for safer loading and eliminate serious transportation hazards.

"The committee, fully realizing that additional securement on some commodities is necessary for greater safety and to prevent the costly shopping of so many disarranged loads in transit, has repeatedly appealed to the member roads, requesting their co-operation in this respect. Despite this urgent appeal, only a few more or less isolated and incomplete reports have been received. To say the least, this is very discouraging to your committee.

"The day is long past when new and revised loading regulations can be published without first conferring with representatives of the larger industries; hence, railroad men should always bear in mind that without their continual and complete reports of load failures, under ordinary operating conditions, your committee cannot always convince the Shippers that added securement is necessary to provide safe loading.

"It is a well-known fact that thousands of cars are being shopped for load adjustments in transit, and if the total losses created thereby could be ascertained, they would no doubt reveal information to convince all concerned that from standpoints of safety and economy, there is nothing more important in railroading."

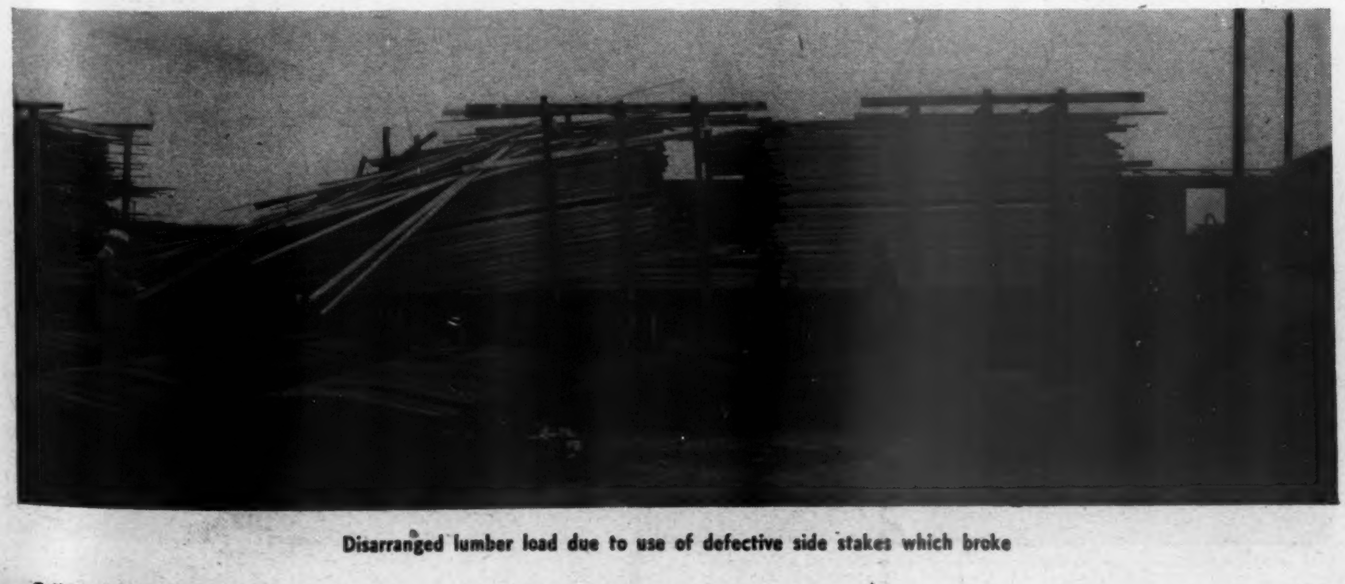
The cooperative action your committee has in mind is along the lines, hereafter, specified:

Report all accidents brought about by loads becoming disarranged to the extent of creating dangerous conditions, or injuries, or loss of life, or damage to property as follows:

Date and place where accident occurred.

Initial and number of car.

Name and location of shipper.



Disarranged lumber load due to use of defective side stakes which broke

Dislodged tractor due to nails not being fully driven and others driven in decayed floor

Kind of load and number of figure under which it had been secured.

How and to what extent load was disarranged.

Exact reasons for the creation of conditions making for potential accidents.

Why, and how, injuries, or loss of life, or damage to property occurred.

Had load originally been secured in accordance with A. A. R. Loading Rules.

If not properly secured, explain by reference to the general A. A. R. loading rules, figures and items under figures.

Furnish recommendations for better loading, if possible.

Address all reports to V. R. Hawthorne, executive vice-chairman, Mechanical Division, Association of American Railroads, 59 East Van Buren St., Chicago, Ill.

We, no doubt, have representatives here from most, if not all, of the territory covered by the A. A. R. and if each of you will spread this helpful gospel, it will surely go far toward approaching the goal the A. A. R. Loading Rues Committee is so earnestly striving for.

If the members present think well of these recommendations, and feel that you can prevail upon your executive officers to pitch in, your committee would like to have you adopt the following resolution:

"After listening to and discussing the report of our Committee on Loading Rules at Chicago in September 1947, we, the members present, agree to do all we can toward cooperating as suggested. It is further agreed that a copy of our committee's report, and action taken, shall be sent to V. R. Hawthorne, executive vice-chairman, Mechanical Division, A. A. R., with the request that he transmit them to the secretary of the Car Department Officers' Association for compilation, for the purpose of enabling our members to determine at their 1948 meeting to what extent these promises have been fulfilled."

Successful handling of his highly important matter will most certainly convince our employers that our association is worthy of full support.

Another matter serious enough to be brought to your attention is the extensive manner in which Loading Rule 20 is being ignored. This rule provides, in part, that when heavy metal or stone is short enough to fall through door openings in gondola cars the drop doors, with specific exceptions, must be covered with lumber not less than two inches thick and secured so as to prevent displacement. The cost of such protection is high, and with lumber as scarce and expensive as it is today, it seems certain that no shipper will comply with this rule unless forced.

A recent investigation made has revealed that thousands of such cars are unfit to carry this short material without the aforementioned protection, and it is believed that if you will look into this you will decide that it will be highly desirable to have them reinforced well enough to make the covering of doors with lumber unnecessary for safety.

Much more could be said about this, but the Committee believes that after proper consideration of the above, you will fully realize all the serious angles involved.

The report was presented for the committee by F. A. Shoulty (chairman), assistant superintendent car department, C., M., St. P. & P., Milwaukee, Wis.

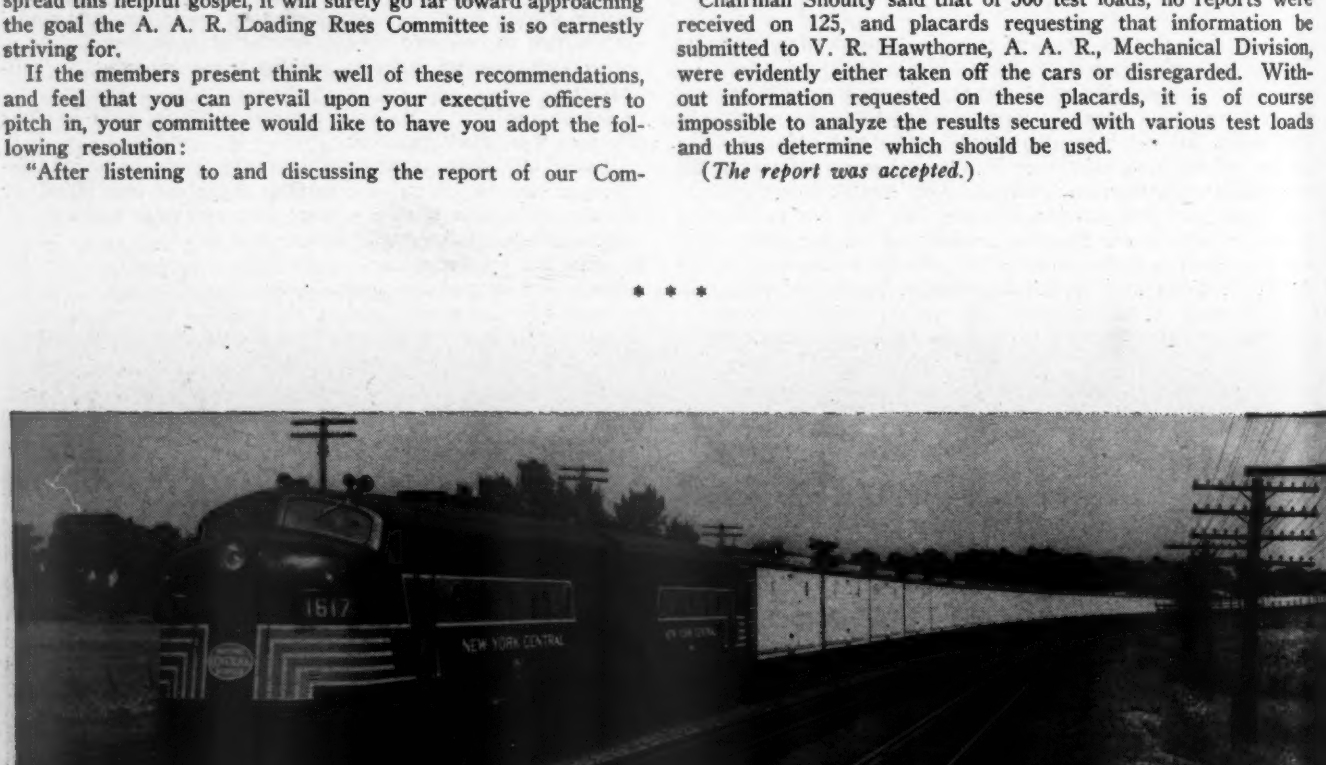
Discussion

In connection with this report, 40 lantern slides were shown indicating various types of road failures. The discussion emphasized the difficulty in getting shippers to comply with present loading rules and appreciating the serious nature of defective securement of loads on railway cars and resultant damage or serious accidents.

Chairman Shoulty said that of 300 test loads, no reports were received on 125, and placards requesting that information be submitted to V. R. Hawthorne, A. A. R., Mechanical Division, were evidently either taken off the cars or disregarded. Without information requested on these placards, it is of course impossible to analyze the results secured with various test loads and thus determine which should be used.

(*The report was accepted.*)

* * *

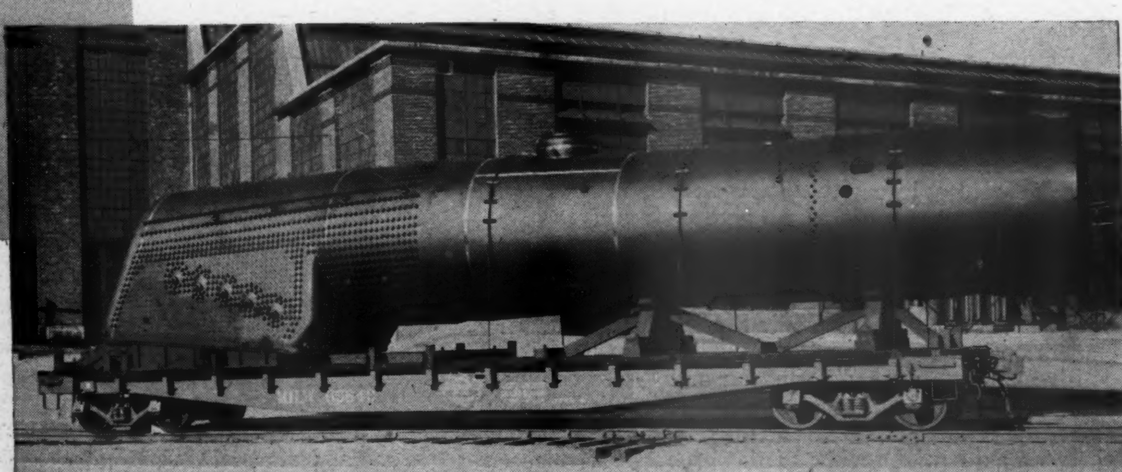


Practical Ideas for Improving Boiler Performance

Reports and Addresses at the Meeting

- * **The Prevention of Cinder Cutting**
- * **Welding of Boilers and Tenders**
- * **Steam Locomotives of the Norfolk & Western**
- * **Staybolt Application and Maintenance**
- **The Cracking of Locomotive Boilers**

* ***Reports indicated by asterisk appear in this section.***



Locomotive Boiler Problems

Master Boiler Makers' Association discusses new developments in steam locomotive boilers at annual meeting

Frank A. Longo, President

S. Christopherson, Vice-President

A. F. Stiglmeier, Sec-Treas.

THE thirtieth annual meeting of the Boiler Makers' Association was held at the Hotel Sherman, Chicago, on September 15-18 inclusive, with an attendance of 257 members and 81 guests. The meeting was opened by President Frank A. Longo's address on Tuesday morning, September 16, in which he reviewed the work of the association and expressed its appreciation for the support given to it by the railway supply companies and other organizations.

Following the president's opening remarks the meeting was addressed by D. V. Gonder, general superintendent motive power and car equipment, Atlantic Region, Canadian National, an abstract of his speech being included in this issue. At the opening session the meeting also heard a short talk by John M. Hall, director, Bureau of Locomotive Inspection, Interstate Commerce Commission, who expressed his admiration for the work of the association.

At the session on Wednesday morning C. E. Pond, assistant general superintendent motive power, Norfolk & Western, gave an illustrated talk on the latest developments in steam locomotives on the N. & W., an abstract of which is also included in this issue. At other sessions three new steam locomotive boiler designs were presented in separate papers prepared and delivered by A. J. Townsend, vice-president, engineering, Lima Locomotive Works; Arthur Williams, vice-president, The Superheater Company, and Howard L. Miller, metallurgist, railroad development, Republic Steel Corporation. These papers on boiler design will be published in later issues.

Five subjects were reported on and discussed during the meeting. Three of these reports are published in this issue, the report on "Study of I.C.C. Rules and Regulations", was a brief review of the progress of this committee to date made by Carl A. Harper, chairman, who said, "There are not sufficient data at this time to make any specific recommendations and the committee suggests that the study be continued next year." The report on "Application and Maintenance of Flues, Tubes and Arch Tubes" will be published in a later issue.

The new officers elected to serve during the coming year are: President, Sigurd Christopherson, supervisor of boiler inspection and maintenance, New York, New Haven & Hartford; vice-president and chairman of the executive board, Edward H. Heidel, general boiler inspector, Chicago, Milwaukee, St. Paul & Pacific, and secretary-treasurer, Albert F. Stiglmeier, general supervisor boilers and welding, New York Central. E. H. Gilley, general boiler foreman, Grand Trunk, and R. W. Barrett, chief boiler inspector, Canadian National were re-elected to the executive board for one year with Mr. Gilley also serving as secretary of the board. S. G. Long, general boiler foreman, Southern Pacific, was elected to the executive board for one year to fill the office vacated by the retirement of B. C. King, formerly general boiler inspector, Great Northern.

The advisory board for the following year consists of E. R. Battley, chief of motive power and car equipment, Canadian National; B. M. Brown, general superintendent motive power, Southern Pacific; A. K. Galloway, general superintendent motive power and equipment, Baltimore & Ohio; F. K. Mitchell, general superintendent motive power and rolling stock, New York Central, and H. H. Urbach, mechanical assistant to executive vice president, Chicago, Burlington & Quincy.

Gonder Speaks on Benefits

The address by D. V. Gonder, general superintendent motive power and car equipment, Atlantic Region, Cana-

dian National, on the benefits and advantages of the association to the railroads is presented here in abstract form.

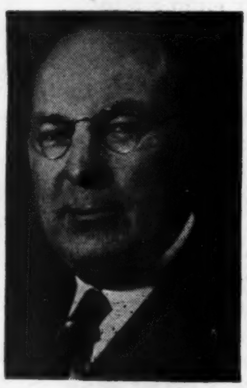
"Machines of infinite variety and scope are in operation, undergoing manufacture, or in process of development. One can never tell what the morrow will bring forth in the field of mechanics, but of one thing we can always be sure—the effectiveness of any device is limited by the hand that maintains and operates it. The human element will always be paramount. Just as we are particular to see that the fitting of staybolts, the size and spacing of rivets, or firebox welding are such as to assure us of a safe and useful pressure vessel so we should be careful to choose, prepare and fit our personnel so that our mechanical department organization can stand the high pressure of the demands made upon it.

"This association should be, and I believe is, one of the textbooks from which an important section of the mechanical department supervisors improve their working knowledge. One cannot give you the headings of all the chapters of this book, but I shall try to outline a few important items.

"First of all, it keeps you up to date. Instead of having to beat a pathway through the desert to the door of that man who builds a better mouse-trap, it is brought right here for you to view. In your discussion periods you learn of your neighbor's latest practices and return to your own roads with a host of new ideas. Many things we have to learn for ourselves, others we can learn, through the experience of others. All of us have had the sad experience of thinking we had the solution to some knotty problem, only to realize that we have made a big mistake by the time it is standardized. Here there is an opportunity to discard, without personal trial, the ideas others have found unsound, just as there is an equal opportunity to cash in on the many improvements others have tried with success. I will be much mistaken if some warmly supported methods of last year's convention are not thrown into the discard at this one. In this connection let us realize that you will win higher respect by frankly telling others when the idea you so warmly advocated does not work. If you dropped it like a hot cake, warn the other fellow before he gets his fiingers burned.

"Still another point is the fostering of cooperation between member supervisors. We all know the maxim 'United we stand, divided we fall.' It may not be entirely true, but there has been ample proof that we can gain more by working together than apart. Here you are bound to consider your joint problems from the viewpoint of the other man to a greater extent, and to your own profit.

"Then there is the broadened vision each person attending this gathering is bound to gain by his travel over and contact with someone else's line. It is easy to



A. K. Galloway

F. K. Mitchell

E. R. Battley

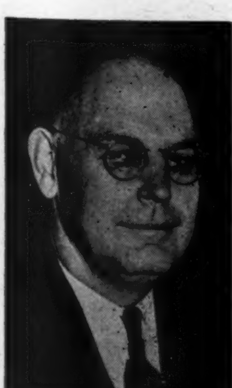
Master Boiler Makers' Association 1945-46

Officers

President: *Frank A. Longo, general boiler inspector, Southern Pacific, San Francisco, Calif.*

Vice-President: *Sigurd Christopherson, supervisor boiler inspection and maintenance, N. Y., N. H. & H., New Haven, Conn.*

Secretary-Treasurer: *Albert F. Stiglmeier, general supervisor, boilers and welding, New York Central System, New York.*



B. M. Brown

Advisory Board

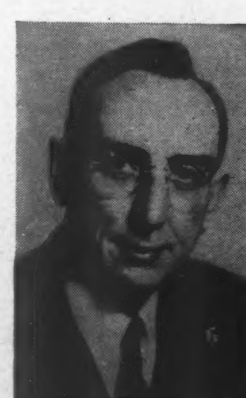
A. K. Galloway, general superintendent motive power and equipment, Baltimore & Ohio, Baltimore, Md.

F. K. Mitchell, general superintendent motive power and rolling stock, New York Central System, New York.

E. R. Battley, chief of motive power and car equipment, Canadian National, Montreal, Que.

B. M. Brown, general superintendent motive power, Southern Pacific, San Francisco, Calif.

H. H. Urbach, mechanical assistant to vice-president, Chicago, Burlington & Quincy, Chicago.



H. H. Urbach

become narrow and insular. It is dangerous to be self-complacent. As an officer of the largest transportation system in America, I am proud of the Canadian National Railways and feel that our mechanical department is not behind that of any other railroad on the continent. Nevertheless any opportunity is welcomed to leave the territory of my jurisdiction, so that my working horizon may be extended in learning from others the way in which they perform their work and meet their problems.

D. V. Gonder

"We should not overlook the benefits from the opportunity for self-expression, particularly among the younger supervisors at these conventions. Nor should they be discouraged by the sound of their own voices. Many a splendid idea has, no doubt, never been developed, because its author could not express himself in words. Here there is a chance to overcome such a handicap. We should never be self assertive enough to be objectionable, but a reasonable self confidence is essential to personal efficiency. It is my practice to tell new supervisors that they are placed where they are because we have confidence in them and they are, therefore, justified in having confidence in themselves.

"Finally, attendance at this convention should enhance the sense of importance and responsibility attaching to each supervisor. Here are discussed vital problems; here are met the best of the railroads' supervisors. Here there should be a keener realization of our obligations not only as railroad men, but as respected citizens and neighbors. A good sponge has great capacity to absorb. It should have an equal capacity to give. I say advisedly that among all the mechanical crafts, none has a better reputation than the boilermakers for sound judgment and integrity. Especially in these trying days let us encourage one another to demonstrate these qualities in a manner that will most benefit all with whom we come in contact."

Reading 4-8-4 Locomotives

A description of the Reading's Class T-1 locomotives of the 4-8-4 type and some comments on their operation were presented to the meeting in a paper prepared by B. G. Kantner, general boiler inspector, Reading. A description of these locomotives appeared in the April, 1946, issue of the Railway Mechanical Engineer, page 198, and only the comments on operation are given here.

Mr. Kantner said, "The Reading Company has recently completed the conversion of 30 steam locomotives from the 2-8-0 wheelbase type to the 4-8-4 type. The first of these locomotives was completed September, 1945, at the Reading Locomotive Shops, located at Reading, Pa., and the satisfactory results obtained by the operation of these re-designed locomotives since that time have fully justified the cost of conversion, through the economies and improvements effected in the fast freight service.

"The first of these converted locomotives has been in service since September, 1945, with a mileage in excess of 100,000 miles, and only minor boiler repairs have been required. Inspection shows the water surfaces of the boiler sheets and tubes to be clean and practically free from evidence of scale formation. The boiler feedwater supplies in the districts over which the locomotives operate contain calcium carbonate and sulphate salts, which if not counteracted would cause the formation of a hard limestone boiler scale. Boiler water chemical treatment with careful supervision of the application of the proper chemicals and of the blowing down of the locomotive boilers, both on line-of-road and at engine terminals, has effected the clean condition of the interior boiler surfaces as above noted. Also, the proper control of the chemical condition of the water in the boilers increases the operating efficiency of the locomotive and increases the number of hours of locomotive availability. Cleaner boilers also result in reduced repair and maintenance costs.

"The locomotives are provided with a Cyclone type front-end arrangement, and it has been found that apparently the unusual smokebox length made necessary by the long wheelbase of the locomotive has had a favorable effect on the drafting as there is no difficulty in maintaining full steam pressure in service. Also, it is interesting to note that cinder cutting does not occur in the firebox or flues, but has been found to some extent in the stack lift pipe and extension in the smokebox. It is probable that the ample grate area with resultant favorable fuel consumption has some bearing on this, as cinder cutting on the Reading has never been a serious problem.

"The satisfactory results as obtained through the operation of these re-designed locomotives and from other locomotives throughout the nation, indicate that the steam locomotive of modern design still plays a most important part in solving the transportation difficulties of the railroads of today."

The Prevention of Cinder Cutting

Some observations on the causes of cinder cutting and a review of three methods for minimizing the condition

During the last session of the meeting a paper on cinder cutting was presented by A. F. Stiglmeier. This paper was compiled by Mr. Stiglmeier from material furnished by several authors, the major portion being contributed by Frank P. Roesch, formerly vice-president, Standard Stoker Company. The paper reviewed in detail the theory of combustion in the steam locomotive and the means that have been developed for improving combustion and drafting. The following abstract of the paper includes only that part of the paper that deals with the methods given for reducing cinder cutting.

There is one thing to keep forever in mind and that is *the lbs. of coal fired per sq. ft. grate area per hr.* That is the crux of the entire matter. The high firing rate of today is the answer to the demand for high capacity operation. The majority of road locomotives are now stoker fired. In general the coal is blown into the firebox through and against the gas stream at or near the point of its highest velocity. A considerable quantity of the fine particles never reach the firing bed, but are caught up in the high velocity gas stream and are only partially burned in suspension. A great deal is heard about cinder cutting, but very little about fuel loss or inefficient combustion. One way to reduce cinder cutting is by improved combustion.

The ultimate cure, of course, lies in the prevention of the cinders. That would lead into design of new boilers and this is not the time or place to go into that phase. The immediate problem is what to do about cinder cutting in the existing locomotives. It is felt that it would be a waste of time to deal with the grade and size of coal, cross-sectional areas through the boiler, etc., as you will continue to use the grade and size of coal furnished and no doubt the cross-sectional areas are established. However, the area between the top of the arch and the crown sheet is important and, once properly established, should be maintained.

Prevention by Design

The two obvious methods of reducing cinder cutting in existing locomotives are to eliminate the placing of essential parts in the path of the gases and the reduction of cinders to the minimum possible. In a number of cases we know that it is impossible to relocate essential parts. In such cases it is generally possible to protect with shields that will do no damage to the locomotive operation when they are cut and can and should be renewed at established intervals. This is not always done. One example of this protective measure is the application of shields to superheater units, which will be illustrated by pictures. Careful consideration should be given to the proper use of feedwater heating equipment. Look to your front ends to see that they give proper drafting. It is necessary that the drafting arrangement should pull enough air into the firebox to give a good steaming locomotive. Any unnecessary increase in the air will both increase the unburned fuel loss in weight per hr. and will also increase the velocity of gases through the boiler. In this way, the result of unnecssary excess air is doubly harmful. Also, why is not more study given to secondary air to improve combustion? Improved combustion means a reduction in cinders.

Prevention by Maintenance

Cinder cutting can be greatly reduced by maintenance. Assuming that a locomotive is outshopped in A-1 shape so that the amount of coal consumed will be a minimum, it is then essential that all parts be maintained in first-class condition. Such items would include ash pan air openings, grates, arch, flues, superheater units, feedwater-heating equipment, front ends, and valve-gear settings. The cleaning of flues cannot be overemphasized, because clean flues permit the use of all the available flue gas area. If a portion of the flues and tubes become stopped with cinders, the load on those remaining open becomes proportionately greater, and consequently increases the gas velocity. At regular intervals closely inspect shields and replace when necessary.

Prevention by Operation

Careful handling of a train by an engineer will generally eliminate the necessity for peak firing loads. The fireman should burn an even fire over all the grate area so that each part of the grate is doing its share in effecting combustion. Unburned coal losses increase directly with a reduction in grate area. Consequently, if all the grate area is not utilized at all times by proper distribution of the coal, there is not only a loss in heat absorption, but there is additional increase in cinders with greater velocity, resulting in cinder cutting.

Conclusion

As inferred above, cinder cutting is here to stay. It has increased a great deal in recent years and we all know the reason why. Under present operating conditions the flow of cinders at high velocity through the locomotive boiler can never be entirely eliminated. The cutting is insidious, and takes place over a period of time. Therefore, it is not easy to observe and correct before damage is done. The proper thing to do is to anticipate such conditions and set up a strict program for prevention by proper design, maintenance and operation.

Welding of Boilers and Tenders

A review of the applications of welding and cutting in the boiler shop for the fabrication of new parts and the removal of old ones—Design for welding important

The use of fusion welding is universal in the railroad industry. Until recently, however, fusion welding has been largely restricted to the stayed portions of locomotive boilers, and to non-pressure parts such as locomotive tenders, water and fuel tanks, etc. The use of fusion welding where locomotive boilers are concerned is still restricted to stayed portions of the firebox, the smokebox, etc., except where the welding is done in conformity with the rules set up by the various regulatory bodies. The past few years have, however, seen considerable advance made in the use of fusion welding for pressure vessels so that a number of all welded locomotive boilers are now in service on several railroads.

This committee has chosen to review the methods used by the locomotive builder in fabricating all welded boilers as part of this report.

[Note: Included in the report but omitted from this abstract was a detailed description of the methods used by the builder.—Editor.]

There has been some discussion as to the necessity for stress relieving. It is the opinion of this committee that stress relieving should be continued because of the stresses set up in the material due to the rolling, flanging, welding and other fabricating processes.

Some discussion has also been had in regard to the possibility of discontinuing the X-ray examination of seams in the stayed area. The committee does not believe that this practice should be discontinued or that spot check X-ray examinations of these seams should be permitted. Instances have been known where defects were missed when spot check examinations were made and the defects were found later when the full length X-ray examination was made.

The practices followed by the railroads in welding have been established over a long period of time to meet individual conditions and problems, and the procedures which have proven most successful have been adopted as standard. The cutting torch is used to great advantage in removing sheets, staybolt and rivets and in cutting off staybolts and radials for driving. Preparing edges to be welded, and fitting of sheets, syphons, circulators, cutting irregular shaped sheets and scarfing of sheets are also done to advantage with the cutting torch. To obtain the proper tolerance, the layout of firebox sheets is made with sufficient stock so sheets can be trimmed to a close fit. The opening for welding is held to a maximum included angle of 60 degrees. Opening at throat of weld is slightly smaller than the diameter of electrode used, and electric welding is used entirely on boiler work. The electrode material is approved by the laboratory, and only qualified welders are used for boiler welding. The welding of ¼-in. firebox

sheets is done in two passes, and where thickness of sheets requires, additional passes are used.

In firebox welding, ⅛-in. and 5/32-in. electrodes are generally used to assure full penetration to the water side of the sheet when welded from the fire side and not accessible from the water side. Whenever accessible, welding is also done from the water side. Generally, fireboxes are entirely of welded construction. All flues have beads welded at the firebox end, and sheets welded

E. H. Heidel,
Chairman

to mudring at the mudring corners. On some classes of power the use of seal welding of caulking edges in stayed area has been used very successfully. The welding procedure used is the sectional back step method when applying the first layer of weld. The second layer is made continuous in either direction. By using this method contraction is retarded and distortion is held to a minimum.

Welding is also used to good advantage in fabricating tender tanks. Oil tanks for oil-burning locomotives are of all welded construction and designed for welding. Flanges at corners have 5-in. radius and a long flange which locates the weld on the straight surface of the sheets approximately eight inches from the corner.

The success of welded construction depends a great deal on design and more consideration should be given to all-welded construction. Seal welding at staybolts has been permitted in some cases by the Locomotive Inspection Bureau of the Interstate Commerce Commission. During the past year a few Railroads have standardized on this practice for some classes of power, indicating that definite progress has been made along this line. Some roads have followed this practice for some time and feel that it is beneficial and does not interfere with the requirements of the Locomotive Inspection Law and Rules. Welding is applied to new staybolts only, and no repairs must be attempted by welding after the locomotive is in service. It should be understood that the staybolts must be properly hammer tester as required by the rules. It is claimed, and results seem to bear out the contention, that the welding of staybolts to the side will greatly prolong the life of firebox side sheets and eliminate leaking staybolts to a great extent.

The members of the committee are E. H. Heidel (chairman), general boiler foreman, Chicago, Milwaukee, St. Paul & Pacific; B. G. Wollard (vice-chairman), system welding instructor, Chicago North Western; F. R. Milligan, general boiler inspector, Canadian Pacific; J. A. Graulty, assistant superintendent of plant, boiler department, American Locomotive Co.; V. B. Vogel, welding supervisor, Chicago, Rock Island & Pacific; and J. F. Richard, welding supervisor, Canadian National.

Discussion

After the presentation of the report several written and verbal comments of the topic were made, the first being in the form of a minority report by a committee member, J. A. Graulty, assistant superintendent of plant, boiler department, American Locomotive Company. Mr. Graulty's remarks follow:

As a member of the committee on Topic No. 2 I feel I should express to you my opinion as to the recommendation of the committee regarding the full and complete X-raying of the seams in the stayed areas. I have expressed my disagreement as follows:

We are distinctly in favor of a spot X-ray check, certainly in the stayed areas, because modern welding practice, particularly with automatic welding machines, does not allow the possibility of bad defects in a small area surrounded by otherwise perfect welding. There may be minor defects missed by spot X-ray checking and they should be allowed to remain in the job, whereas major defects, such as lack of fusion between passes or extensive porosity, will be revealed by a spot check. The argument concerning minor weld defects and their harmlessness should be faced frankly and compared with the inherent serious defects associated with riveted construction and also the long history of successful firebox welding and our frank admission that portions of those welds were not perfect.

The joint faces of the circumferential seams are trued by this grinding machine before the courses are welded together

My objection to routine X-ray inspection of welded seams in the stayed area is because of its far-reaching consequences. When recommended by our association it may become incorporated in the code which will be binding on the railroads, necessitating complete X-ray equipment including highly trained specialists.

We, as manufacturers, have to submit to customer demands as laid down in specifications but complete X-ray should, by no means, be a general rule. It is true that our company put in their specifications the complete X-ray of the external parts of the boiler, including, of course, the stayed areas. The thought in back of all this was to impress upon our force the importance of quality work on all welded-design boilers, and to trust to our technicians and radiographers that they lend their knowledge and experience to a more liberal interpretation of rejections in stayed areas. In other words, do we need 100 per cent quality work in stayed areas? For years we have been welding fireboxes without any failures. Yet we know that a considerable amount of our work would not meet code specifications. When obvious good workmanship and care by qualified welders will technically satisfy, why create delays with considerable cost of time and equipment.

We accept the parent metal that goes into boiler fabrication with the knowledge that we are getting material made by the best known practice backed by years of research. Yet how many plates would pass the "Supersonic Reflectoscope" test?

The fact is that the quality desired can be met by "spot check" in stayed areas with a satisfactory guarantee.

Another Committee Member Speaks

A second member of the committee, F. R. Milligan, general boiler inspector, Canadian Pacific, spoke on the changes in shop methods that are necessary if riveted boilers are going to stay in competition. That part of his comments dealing with the shop procedures for riveted construction are omitted from the abstract which follows:

If riveted boilers are going to hold their place with all-welded boilers and other types of locomotives, there will have to be some radical changes made in the present method of shaping and fitting boiler plate, particularly barrel courses in our own back shops and the manufacturers' shops; quality and not quantity will have to be the governing factor.

While it is too soon to say the all-welded construction is a cure-all, it is certain they will not develop cracks in rivet holes at the longitudinal joints, rivet holes in check pads and rivet holes at dome connections. It is these defects that are resulting in costly repairs and keep the locomotive out of service for long periods of time, and consequent heavy cost of repairs that our railway managers give considerable thought to when considering buying new power, with the result they look more favorable on other types of power.

Steel Producers' Comments

Two representatives of the steel manufacturers presented written discussions of the report. They were W. P. Gerhart, metallurgical engineer, Bethlehem Steel Company, and W. K. Cole, manager, railroad sales, Lukens Steel Company, and abstracts of both discussions are given here. Mr. Gerhart's comments follow:

To touch on quality of steel plates, and the progress that has been made in keeping up with the ever increasing demands for better and stronger steels for power boilers, it is well to point out there has been no steel used in the past that can be condemned with respect to welding performance. Of course, there has been the occasional bad lot of steel regardless of the care used in its making or the rigidity of the inspection methods employed. What I am endeavoring to point out is that all types of steel plates, whether they be made by the rimming or deoxidized practice, have their place in the field of welding and can be so regulated to the method of welding as to obtain a satisfactory end use.

Today the steel works' metallurgist scrutinizes all orders from the various fabricators; usually he has visited their plants and he knows whether they are using manual welding or automatic welding; he also knows whether multiple layer welding is being used or whether one-pass submerged arc methods are employed.

From this information the proper grade of steel is prescribed; this goes to the Open Hearth Department where trained steel workers cooperating with metallurgical technicians see that the material is made to the specifications best suited for the particular type of welding involved. It is my opinion that this practice has done more to improve welding and place it in its present enviable position than any other single phase of the entire procedure.

Steel quality does not stop here, however, for with the welded pressure vessels, it was possible to test them to destruction, never possible with rivet construction, due to leakage at the rivet holes. This enabled the technician to secure valuable data on stresses previously unknown; also, much was learned about flanged and dished heads as to the location of the failures, resulting in new designs involving semi-elliptical and elliptical shapes as well as various other forms of heads.

With these conditions better known, the payload came into the picture, for why build heavy locomotives to secure additional steam power, by using thicker materials in the boiler shells, if stronger steels were available. As a result, alloy steels have come into the pressure vessel field thereby causing the steel works' metallurgist's hair to turn a little more toward the pale side. Better known among these steels are carbon-moly, carbon-mang-moly, the nickel steels and many others.

These steels can be welded by the usual methods, it perhaps being wise to use a little preheat at time of welding, especially with tack welding for fitting up. Cracks that occur in tack welding may be fused out by the major welding process. However, they have been known to remain and show up in the X-ray examination, thus requiring chip-outs, rewelding, etc., which certainly is not profitable to the fabricator.

The committee report is a very thorough description of the procedure used in fabricating locomotive boilers by welding. Illustrations of some of the welds would clarify the text if they were available. The bevels for submerged arc welding appear to be excessively wide. It is our opinion that wide bevels increase the amount of electrode necessary and lead to occasional difficulties in passing bend tests. A comparison of the prescribed welding technique from four sources: (1)—Committee report, (2)—Lincoln Electric Company, (3)—Linde Unionmelt, and (4)—Bethlehem Steel Fabricated Construction, shows that the prescribed practice is to use a 60 or 70-deg. bevel in place of the 100 and 110-deg. bevels mentioned by the committee report. Since royalty on the Unionmelt process is on the basis of electrode consumed, considerable economy can be realized by reducing bevels and the amount of electrode necessary. Welding speeds are about comparable in each case.

The technique of assembling and completely welding separate rings differs from tank and pressure vessel welding technique, wherein the entire vessel is frequently tack welded and then finish welded as a unit. The method described in the report with the truing up of each ring undoubtedly reduces residual stresses in the vessel but adds considerably to the cost.

It is our opinion that the application of welding to locomotive construction has lagged behind that in other fields and we are glad to see the committee report, which should increase interest in the welded locomotive.

In conclusion, may I add a word of caution to this seemingly glorious achievement, weldability. Pressure vessels depend upon safe and sound welds and failures of vessels usually result in loss of life. Motive power is far different from stationary service; for in the steam locomotive high stresses, mostly dynamic in nature, are present more frequently, thereby taxing both the parent metal and the weld metal to the utmost. A little carelessness here and there during the fabrication, a questionable weld not properly X-rayed may lead to serious consequences.

W. K. Cole's Remarks

Your committee's report on the fabricating methods employed by the builders in the construction of welded locomotive boilers, fireboxes, and tenders has described what we in the steel industry would deem to be an excellent example of sound shop practice. We shall all agree that such technique combined with competent supervision and careful inspection is the essential basis for quality production welding. This practice as outlined conforms to the best fabricating practice, employed by any of the experienced shops engaged in building high pressure boilers and other similar vessels. In view of this fact and with the satisfactory applications in service to date, the railroad industry should feel confident that their equipment, built in accordance with accepted welding procedures, is both efficient and safe to operate.

The development of the welded boiler has been a long term research project; and today we are all confident that it has met with marked success. In any development program however, we must proceed cautiously at the start, utilizing for example, those materials which past experience has proved to be the most readily workable and the most likely to succeed. Thus, in this instance A-201 steel was selected, a killed steel, readily weldable. However, the success of this initial step is generally accepted, and it would appear that we are ready for the next logical step in the development, namely, the consideration of those materials which will prove the most economical from the standpoint of initial cost, maintenance cost, service life and design.

The use of the low-alloy steels is not new to the railroads and the locomotive builders. For years these steels have been used and are still being used by many of the railroads in their riveted boilers and firebox construction. In many instances, they have met with marked success, while in other instances the full value of these materials has not been realized. There is no doubt in my mind but that the inherent fabricating problems associated with riveted construction contributed considerably to this latter condition, and the substitution of welding in conjunction with the use of these higher tensile steels should fully develop their most efficient application.

Among the various standard specifications that should be considered as possible applications in the welded locomotive boiler are: nickel steel A-203, carbon-molybdenum steel A-204, manganese-vanadium steel A-225, and silico-manganese steel A-212. Some typical physical properties obtained from welded plates of these materials are shown in the table.

In closing, I should like to mention one other steel which has come into prominence in many industrial applications, namely, clad steels. Many of you have heard of and used the clad steels which combine the advantages of corrosion resistance at only a portion of the cost of the solid materials. Where corrosion is encountered, these composite plates, integrally bonded together as one piece of material, have proven to be economical in regard to length of service and operation without repairs. The fabrication of these steels, whether it be nickel, monel, inconel or the many varieties of stainless-clad steels, is a matter of commercial shop procedures throughout the fabricating industry. The strength of the bond has been tested under severe conditions and found to be a compact unit of corrosion resistant material on the one side with carbon steel making up the major portion of the thickness for reduced cost.

Thousands of tons of these materials have been successfully used in the fabrication of stationary pressure vessels. Shop procedures such as outlined by your committee have been used in the fabrication, by welding, of these structures. They have been proven beyond doubt to be commercially efficient and safe. With the facilities available in the shops of the locomotive builders to enable satisfactory welding, X-ray and heat treatment, and with these fabricating shops in other fields having already performed the experimental work, we have only to utilize the benefits of this equipment and experience to bring forth a locomotive, which I am certain will establish a new record in service performance.

Typical Physical Properties Obtained from Welded Low-Alloy Steels

Nickel Steel A-203 Grade "A" Firebox

Analysis:	C — .12 Mn — .40 Si. — .21 Ni — 2.17
Plate thickness:	½ in.
Plate properties:	
Yield point	42,100 lb. per sq. in.
Tensile strength	69,400 lb. per sq. in.
Elongation	26.5 per cent
Weld properties (stress relieved):	
Free bend test (elong. across weld)	65.7 per cent
Reverse bend test	56.2 per cent
Tensile strength	65,200 lb. per sq. in.

Carbon-Molybdenum Steel A-204 Grade "B" Flange (Boiler)

Analysis:	C — .16 Mn — .71 Si — .23 Mo — .42
Plate thickness:	1⅛ in.
Plate properties:	
Yield point	44,600 lb. per sq. in.
Tensile strength	78,300 lb. per sq. in.
Elongation in 8 in.	26 per cent
Weld properties (stress relieved):	
Free bend test (elong. across weld)	58.3 per cent
Reverse bend test	49.3 per cent
Tensile strength	76,600 lb. per sq. in.

Manganese-Vanadium Steel A-225 Grade "A"—Firebox

Analysis:	C — .12 Mang. — 1.05 Si — .22 Va — .092
Plate thickness:	⅜ in.
Plate properties:	
Yield point	58,600 lb. per sq. in.
Tensile strength	78,400 lb. per sq. in.
Elong. in 8 in.	24.5 per cent
Weld properties (stress relieved):	
Free bend test (elong. across weld)	71.4 per cent
Reverse bend	63.9 per cent
Tensile strength	76,700 lb. per sq. in.

Carbon-Silicon Steel A-212 Grade "B" Flange (Boiler)

Analysis:	C — .24 Mn. — .78 Si — .22
Plate thickness:	1 in.
Plate properties:	
Yield point	40,600 lb. per sq. in.
Tensile strength	77,400 lb. per sq. in.
Elong. in 8 in.	26.5 per cent
Weld properties:	
Free bend test (elong. across weld)	57.9 per cent
Reverse bend test	53.4 per cent
Tensile strength	75,900 lb. per sq. in.

Verbal Discussion

A. G. Woolard, a committee member, pointed out that it was not the intention of the committee to include the inside firebox as requiring complete X-raying, only the outside firebox and the barrel courses.

A. F. Stiglmeier said that somebody has to find out how to weld alloy-steel locomotive boilers and until such a boiler is built there will be no satisfactory answer to its possibilities. He suggested that a committee be formed to investigate the welding of an alloy-steel boiler.

A representative of a steel company took exception to Mr. Stiglmeier's comments and pointed out that other fields are welding alloy steels successfully. He said that all that is needed to get an alloy-steel boiler is a customer that wants one. He believed that welding is a useful tool and the welding industry should eliminate the mysticism about the process. In his opinion X-raying will not change poor welding; a mandatory school for welders is more essential.

L. E. Grant, engineer tests, Chicago, Milwaukee, St. Paul & Pacific, said that he believed there is a good future for the steam locomotive and that welded boilers will be essential. His railroad has 12 all-welded boilers, only one of which is in service as yet. He thought that we may have trouble with welded boilers but, if so, not to blame the welding unless cracks are found in the welds, a condition he believed to be very improbable. He was glad oxy-acetylene cutting was reported O.K. for plate preparation.

* * *

A Lehigh & Hudson River double-header near Belvidere, N. J.

Steam Locomotives of the Norfolk & Western

By C. E. Pond

Assistant to Superintendent Motive Power, Norfolk & Western

[In his paper on the design, availability, utilization and maintenance costs of the N. & W.s modern steam locomotives Mr. Pond included some data that was used in a previous speech, an abstract of which appeared in the December, 1946, issue of the *Railway Mechanical Engineer,* page 656. The abstract published here contains only the new information and data not included in the previous abstract. Mr. Pond's paper follows.—Editor].

The N. & W. is a heavy trunk line railway serving six states.

C. E. Pond

The transporting of coal is the principal source of revenue. In 1946, 44,773,000 net tons of commercial coal were handled. This represents 72 per cent of the freight tonnage and 61 per cent of the freight revenue. The coal traffic originates about midway on the line. Approximately 33 per cent of the coal moves east, and 67 per cent is handled west to Columbus and Cincinnati, Ohio. The eastbound traffic must be lifted in excess of 2,500 feet, over three ranges of mountains.

The N. & W. is interested in the development of new types of locomotives, and is a contributor to the project for the development of a pulverized coal-fired gas turbine electric locomotive. The first two coal-burning gas turbine locomotives are tentatively scheduled for completion in the spring of 1948. The N. & W. was also interested in the high pressure, pulverized coal-burning turbo-electric steam locomotive, a project abandoned because of the high estimated construction cost and excessive weight per horsepower.

The efforts at our home shops have been largely concentrated on improving the performance of existing types of steam reciprocating locomotives through refinements of design, intensive utilization, and better servicing facilities.

Since 1936, the N. & W. has designed and constructed 116 modern steam reciprocating locomotives in its Roanoke, Va., shops. These locomotives are of three types: (1) a streamlined passenger locomotive, Class J, with a 4-8-4 wheel arrangement; (2) a single expansion articulated freight and heavy passenger locomotive, Class A, with a 2-6-6-4 wheel arrangement, and (3) a compound Mallet heavy freight locomotive, Class Y5, Y6, and Y6a, with a 2-8-8-2 wheel arrangement. In addition, 22 Mountain-type locomotives, Class K2 and K2a, have been modernized and streamlined.

The N. & W has also developed a coal-burning steam switching locomotive,* with automatic fuel and water controls, which has many of the advantages claimed for other types of switchers, such as high availability, flexibility, reliability, and low operating cost.

Class J Operating Data

The accumulated total unserviceable days for the eleven Class J locomotives as of June 30, 1947, was 1,445 and the average number of unserviceable days per locomotive per month, including shopping for classified repairs was slightly over two. Excluding unserviceable and stored days, the average daily mileage for the locomotives when the first locomotive was placed in service was 295. This has been gradually increased to 531 miles per serviceable day, as of June 30, 1947, on the basis of ten locomotives, one locomotive being used to replace the ones in the shop for inspection or repairs.

The Class J locomotives are used exclusively in main line passenger service. Four of these locomotives are assigned to a pool that handles Trains Nos. 15 and 4, 25 and 26, and 3 and 16 between Roanoke, Virginia, and Cincinnati, Ohio, a distance of 424 miles. Three locomotives are required to handle Trains Nos. 4 and 15, 16 and 3, and 25 and 26 between Roanoke and Norfolk, Virginia, a distance of 252 miles. Three locomotives are required to handle Southern trains operating over Norfolk and Western lines, Nos. 18 and 45, 46 and 17, and 41 and 42 between Bristol and Lynchburg (Monroe), Va., a distance of 209 miles.

The initial cost of the first five Class J locomotives, built in our shops during the years of 1941 and 1942, was approximately $167,000.00 per locomotive.

The accumulated maintenance cost charged to ME-308, including class repairs, for the Class J locomotives for a 68-month period is $15.13 per 100 locomotive miles.

Class A Locomotives

The number of Class A locomotives† owned is 35, and these are in service between Roanoke and Norfolk, Virginia, and between Williamson, West Virginia and Columbus, Ohio. These locomotives have given an outstanding record of performance, except for water carryover resulting in frequent superheater unit repairs and low valve and cylinder packing mileage. A careful study was made of water conditions, and the treatment was found satisfactory. Numerous observations were made of locomotives in service, and it was found that when the enginemen carried up to two inches of water in the gauge glass, no carryover was experienced, but over that amount the carryover was very pronounced. All of the newest baffling arrangements were tried, together with larger domes, slotted dry pipe, etc., but the results were generally unsatisfactory. After conferring with various steam locomotive authorities, this formula was disclosed: the ratio of the evaporation in cubic feet per hour to the cubic foot volume of steam space in the boiler should range between a maximum of 750 to a preferred ratio of 600. A study of the Class A locomotive boiler indicated the ratio of the boiler was above the recommended maximum.

In October, 1946, the crown sheet of one of the Class A locomotives was lowered 3⁹⁄₁₆ in. The water capacity at working level was reduced to 7,570 gallons, and the steam space increased from 231 to 302 cu. ft. This reduced the ratio of evaporation to steam space to the recommended minimum. Since this was done, the performance of the locomotive has been greatly improved, no superheater units have burst in the return bend, the locomotive has been reported foaming only once since October 1946, and the life of the valve and cylinder packing rings has been greatly extended. On the basis of this test, a program of lowering the crown sheets on the remaining Class A locomotives was instituted.

The last block of ten Class A locomotives, which were built during the year 1944, cost approximately $165,000.00 each.

The accumulated maintenance cost charged to ME-308, including class repairs, for the Class A locomotives, is $21.12 per 100 locomotive miles.

Compound Mallet Locomotives

The 2-8-8-2 compound Mallet locomotives, Classes Y5, Y6, and Y6a are assigned to both time and slow freight service in moun-

* A description of the N. & W. automatic switcher appeared in the August, 1947, issue of the *Railway Mechanical Engineer,* page 402.

† A description of the first N. & W. Class A locomotives appeared in the September, 1936, issue of the *Railway Mechanical Engineer,* page 421.

Builder	Company shops	Steam pressure, lb. per sq. in.	220
Locomotive type	4-8-2	Cylinders, number, diameter and stroke, in.	2-28 x 30
Rated tractive force, lb.	63,800	Total length, engine and tender, ft.-in.	100-11
Weight on drivers, lb.	248,150	Tender water capacity, gal.	22,000
Total weight, engine and tender, lb.	738,060	Tender fuel capacity, lb.	30

Streamline N. & W. Passenger Locomotive, Class K2 and K2a

tainous territory. These locomotives are equipped with cast steel bed frames roller bearings on the engine trucks, drivers, and trailing truck journals, and have mechanical lubrication to a total of 213 points.

The last block of these Mallet locomotives, which were constructed in 1942, cost approximately $135,000,00 each.

The total maintenance cost charged to ME-308, including class repairs, is $23.76 per 100 locomotive miles.

Streamlined Passenger Locomotives Class K2 and K2a

During the years 1945 and 1946, the N. & W. rebuilt and streamlined 22 of its Mountain type locomotives at the Roanoke Shops. The general dimensions, weights, and principal proportions of these locomotives are shown in the accompanying illustration.

The major improvements, which increased the reliability of these locomotives, consisted of the application of cast-steel cylinders, renewal of fire boxes, increasing the boiler pressure to 220 lb. per sq. in. application of retractable couplers and smooth faced pilots, extended mechanical and pressure lubrication, replacement of the stoker with a modern type, streamlining, application of oil lubricators to the engine trucks and drivers, application of roller bearings to trailing and tender trucks, and increasing the coal and water capacity of the tenders to 22,000 gal. of water and 30 tons of coal.

These locomotives have 20 per cent less tractive effort than the Class J's, and are called "J Juniors" by the enginehouse forces. The Class K2 and K2a locomotives are assigned to passenger service, being utilized to handle the lighter passenger runs.

The average monthly mileage of these locomotives is approximately 7,000 per locomotive. The average mileage of the Class K2, K2a locomotives before firebox renewals was 1,598,573. This represents an average firebox life of about 2 years, based on an average mileage of 66,000 per year. Since modernization, the average mileage per year has increased to approximately 84,000.

Future of Steam Locomotives

The future of the coal-burning reciprocating steam locomoitve is dependent upon producing locomotives of high availability at a low initial cost, that will have reliability of performance and low maintenance cost, that can be intensively utilized provided satisfactory fuel, coal, boiler water, and better servicing facilities are furnished.

These factors do place some restrictions on the use of reciprocating steam locomotives, which are already burdened with the disadvantage of a low thermal efficiency. The Norfolk and Western Railway has been able to overcome these handicaps (except the lower thermal efficiency, which is inherent in a steam locomotive), and coal-burning steam locomotives are selected to handle our trains, not only because coal is an important part of the tonnage moved by our Railway, but because of the low first cost, the low maintenance cost, and proven operating results.

Figures of the Bureau of Economics, Association of American Railroads, show that throughout the war years and up to and including 1946, the Norfolk and Western Railway's figures for freight ton miles per train hour were the highest of any American railroad 600 miles or more in length. This record speaks for itself, and was made against the handicap of unusually heavy grades and much severe curvature, neither of which is conducive to train tonnage or train speed.

Staybolt Application and Maintenance

Specifications covering the threading of staybolts and the tapping of sheets and round nuts presented as a tentative standard—Shop and enginehouse procedures given

That part of the report dealing with thread standards was prepared and presented by Dr. G. R. Greenslade, director of research, Flannery Bolt Company, and the chairman of the committee. Dr. Greenslade included diagrams, tables and complete specifications for the thread standards in his report, the details of which are not given in this abstract.

W. C. Masters, sales engineer, Flannery Bolt Company, reported on gauges and each of the other committee members reported on their methods of applying and maintaining staybolts, and their comments are summarized herein. The abstract of Dr. Greenslade's report follows.

For years the committees of the association covering matters pertaining to staybolts have from time to time engaged in informal discussions regarding the standardization of threading practice for staybolts and firesheets, and in a general way it has been agreed that the association should adopt the American Standard Special 12-pitch-series—Class 3 Fit Screw Thread. The Association of American Railroads has already standardized on this thread, but neither the Master Boiler Makers' Association nor the A. A. R. has prepared the necessary drawings, abstracted the necessary dimensions and data to set the entire specification forth as a unit prepared solely for boilermakers, and unencumbered by a maze of other thread specification data which does not pertain at all to the staybolt threading problem.

In the specifications I have attempted to set forth as briefly as seems feasible, for the initial presentation, standards covering

the threading of staybolts, tapping of boiler sheets, round nuts, and dimensions applicable to staybolt taps. The need of standardization is evident, when we consider that in the past at least 26 distinct tolerances for the threading of staybolts have been required by various railroad companies and commercial manufacturers of firebox type of boilers.

This situation has improved during the last few years, but at least ten of these tolerances are still in use. Some are based on the outside diameter, some on pitch diameter. Some call for the "V" form of thread, and others specify the American National

Dr. G. R. Greenslade, Chairman

form of thread—without (in most cases) adhering to American Standard limiting dimensions and tolerances for screw threads.

As nearly as I have been able to determine, the manufacturers of staybolts and parts pertaining to staybolts are not primarily interested in what particular standards are established by the Master Boiler Makers' Association and by the railroad companies in regard to the tolerances for staybolt threads, but they are definitely interested in having some standard established. This desire on the part of the manufacturers is not selfish in nature, but is only expressed with the aim of promoting efficiency in manufacturing, and of thus decreasing the length of time required for the making up and shipping of staybolt orders. If a single screw-thread standard for staybolts were adopted by a fairly large number of railroads, manufacturers would be able to build up stocks of staybolts of various diameters, lengths, and styles for immediate shipment in filling rush orders.

It is the prerogative of the master boilermakers and of the railroad companies to determine what standards and tolerances are best suited to work in the boiler shops, and since it has been indicated by various committeemen who have studied the subject over a period of years that the American Standard Special 12-pitch-thread series—Class-3 fit of screw threads is desirable, I am now setting this before you for your consideration.

The tables used in this specification are either abstracted from those contained in A. S. A. Bulletin B 1.1—1935, or the values have been computed from formulae based on fundamental definitions set forth in this bulletin. The descriptive material relating to this particular standard of thread has been re-written or revised so as to be limited to staybolt use. The ranges of limiting and basic dimensions given in the accompanying tables for the 12-pitch-thread series—Class-3 fit of screw thread, have been chosen to cover the requirements for locomotive boilers, stationary boilers, and marine boilers. Many of the definitions employed are taken directly from the A. S. A. specification; others have been modified to fit the present proposed use.

Taken as a whole, everything in this specification which is being submitted to the Master Boiler Makers' Association complies with the requirements for the American Standard screw thread designated above.

W. C. Masters on Gauges

Supplementing Dr. Greenslade's recommended report on screw thread form and tolerances to be used on staybolts and threaded parts applicable to boiler maintenance and construction is the subject of gauge types. With this subject should be studied the maintenance of proper gauges, the checking of threaded products and tapped holes, and the insuring of interchangeability between the tapped hole and the applied products. This subject of gauges and gauge maintenance to maintain the thread standards for mating is one of considerable importance, for without the proper gauges and gauge control it is impossible to maintain a high degree of uniformity for mating parts in interchangeability.

It is recommended to this committee that after the thread form and tolerances be adopted, a committee be appointed to study the form and tolerances for gauges, as it is felt that the gauge subject is a study within itself and too vast to be combined with Dr. Greenslade's report, which very ably covers all phases of the thread subject.

As a tentative schedule for this committee on thread control, it is suggested that they follow the limits of the maximum "go" gauges which control the minimum looseness or the maximum tightness in the fit of mating parts and the use of the limit gauge known as a "no go" gauge which limits the amount of looseness between the mating parts, thus controlling in a large measure the proper functioning of these parts. It is also suggested in this committee's study in checking of tapped holes to take under advisement the use of a truncated gauge for measuring the pitch line only of the tapped hole. This does not necessarily mean that the "no go" plug gauge should be eliminated, but the truncated gauge will give a greater degree of accuracy in checking and indicating the size of the tapped hole at the pitch line, which is very necessary to obtain a high degree of mating of threaded parts.

Christopherson Discusses Shop Practices

The report included descriptions of shop procedures prepared by the individual committee members. Abstracts of these descriptions are given here. That of Sigurd Christopherson, supervisor of boiler inspection and maintenance, N. Y., N. H. & H., as follows.

Occasionally, you hear someone say that the boilermaker is to blame for leaky staybolts owing to poor fit and out-of-round holes. This may be so in a few cases. We believe if such is the case the trouble will be in the threading machine which, in most cases, particularly in a railroad shop or enginehouse, is 40 to 50 years old and cannot give you a good fitted bolt. That was one of our troubles. Every 25th bolt would change, never the same. Some would be up to plus .011 over and some minus .003 under, and it would be a steady walk from the machine to the job and it would be either too tight or too loose. With our new machine, the bolts are the same throughout the job.

We find after a thorough study of what has been said and done that we can prolong the life and reduce the maintenance of staybolts and firebox sheets by the following methods.

A fully-killed carbon firebox steel to maintain sufficient strength at the operating temperature, thus resist fire-cracking and corrugation is necessary. Staybolt spacing is important, a staggered spacing preferred, using a lighter sheet and a closer pitch.

To insure continuity of lead through the two sheets with staybolt taps, the American Locomotive Co. staybolt taps are recommended, these taps having an interrupted thread. The tapping practice must conform to the best requirements, using reasonable sharp threaded taps, good lubrication, reasonable speed, and a balancer to avoid whip and excessive bending.

We recommend double gunning in driving staybolts when air hammers are used for driving up. The use of the top boiler check with proper spray nozzle or baffle plates is highly recommended. Although some roads have good water, we recommend either a clad sheet or suitable inhibitor to prevent cracks in sheet.

The use of staybolts and firebox sheets material which at the operating temperature will have approximately the same strength, will no doubt prolong the life of both staybolts and sheets.

Staybolt Procedure of a Builder

The practices set up at the Lima Locomotive Works were presented by R. J. McNamara, general boiler shop foreman, for that company.

After the side sheets are straightened, our tool room furnishes us with a set of 24 staybolt taps. These taps are held to a tolerance of .001 and are ordered long enough so as to assure a continuous lead through both sheets.

Next, a hole is tapped with each individual tap, using a motor of approximately 300 r.p.m. Test bolts are made to fit, usually a snug pull with a 12-in. wrench. This is usually put up to the customer's inspector so everyone concerned will be satisfied. We ordinarily find that to insure a snug fit, our bolts will run approxi-

mately .002 over specified size. This is due to reaming and tapping, which often causes the hole to be slightly oversize.

After the "fit" is established, our bolt room proceeds to cut one set of bolts; meanwhile the staybolt men ream and tap four vertical rows of staybolt holes using a good lubricant. After the threads in both sheets are sufficiently clean, the bolts are then applied and, if any variation in size is noted, the taps are immediately replaced. The staybolt men proceed to tap four more rows, etc., until the sides are finished.

We do not use squares on the end of our bolts but use the plain round stock. This enables us to have a better chance of centering the bolt in our threading machines. This necessitates using a small alligator chuck in motor to apply bolts which gives us a satisfactory job all around.

We set our bolts approximately two and one-half to three threads on the fire side which gives us a uniform thread to drive. All bolts on the outside are flame cut to about the same length.

In applying flexible stays, the holes are reamed, tapped and cleaned, then inspected. The bolts are applied and then backed off according to specifications.

Too much attention cannot be given to driving a bolt. After all the attention that is given to applying a bolt, it is all for naught if in driving it, a haphazard job is done. We obtain best results by using a "sixty" hammer with a fairly flat die and a heavy bucking-up bar, making sure that each man, both driver and bucker, are on the same bolt at the same time.

As to the seal welded staybolt, I have no experience with these as yet, but "Lima's" next order coming up requires seal welding on the fire side from mud ring up to center line of boiler. I think this procedure will be the answer to leaky bolts in the fire line.

My own ideas concerning seal welding of staybolts would be a slight countersink on the fire side, then run the bolt through the sheet approximately 3/16 inch past flush, upset bolt in center, then seal weld.

Methods Used on the B. & O.

A description of the application and maintenance of staybolts was given by W. H. East, general boiler inspector, B. & O.

Our standard method is to punch staybolt holes 1/4-in. diameter smaller than the diameter of threaded ends of bolts which are to be applied. To date, this method has been very satisfactory. Special alloy steel plate for fireboxes has never been used up to the present time. These holes are reamed, after punching, to allow end of tap to enter easily, and to remove any possible invisible cracks around circumference of holes, which may have developed when being punched. Drilling the staybolt holes will assure that cracks, as mentioned above, would not develop, but this operation requires much more time to complete.

Our standard thread is National Form type, with 12 threads per inch. All taps used are purchased under certain specifications, and are not acceptable, if they are less than normal size, nor more than .002 above, for sizes under one inch, or .003 for one inch or above. The pitch diameter of taps is the gaging point. Staybolt holes are tapped from the exterior of firebox with pneumatic machine operating at 320 to 360 r.p.m.

The tolerance allowed on threaded ends is .002 maximum and .002 minimum above or below required sizes. Bolts with reduced bodies have a tolerance of .015 maximum and .015 minimum, at reduced portion, above and below required sizes.

New staybolts must be reasonably tight in sheets before driving. An allowance of 1/4 in. is made on bolts, beyond sheets, for driving heads, which is done with at least a number 60 long-stroke pneumatic hammer, and bucked with a 46-lb. holding bar. Flexible staybolts are not applied extremely tight. Those applied around syphon and circulator diaphragms are backed off one and one-quarter turns.

Complete application of flexible-type bolts show minimum breakage. Average breakage is two bolts per month. In fireboxes partially equipped with flexible bolts more breakage of rigid bolts was experienced. These were located in the straight rigid radials between the crown bolts and flexible bolts in breakage area, at top of side sheets. This condition was corrected by three rows of additional flexible bolts.

Little trouble is experienced with leaky staybolts. Of course, there are periods of dry weather when water becomes more acid and causes staybolts to leak. These will appear at fireline on side sheets and scattered around firebox including crown bolts. If any firebox at this time shows excessive leakage, the staybolts are re-driven and held on with bucking bar. As this condition does not usually last too long, staybolt leakage is reasonably allowed, to keep from ruining staybolts from excessive driving, and when quality of water improves, all leaking stops.

The Erie's Staybolt Procedures

The practices of the Erie were presented by S. S. McConnell, supervisor of boilers at Hornell, N. Y.

Our railroad has had leaking staybolts and at this time we have corrected most of our trouble. We use hollow iron staybolts. We use 100 per cent water treatment, which is internal treatment that consists of tannin and other organic alkaline salts.

We use taps with U. S. standard form thread with maximum size on new work not to exceed 1 1/16 in. diameter. Threads are within a tolerance of plus .000 or minus .003 on pitch diameter, and plus or minus .0015 per inch of length for variation in lead of thread. All staybolts are drilled in sheets 1/8 in. smaller than tap size. We tap all holes from outside in at a speed to insure good threads. We use a vegetable tapping compound (no white lead), start tapping at the bottom after some scattered holes are tapped and bolts applied to stay sheets, tap four rows and blow out each hole, run in four rows of bolts and set to gauge, continue four rows until application is made. After all bolts are applied, setting is checked with gauge and ends cut off on outer end with acetylene cutting torch.

In driving heads we use a 40-lb. bucking bar with a die in end to insure that the bar is on head of bolt at all times and held with pressure against the bolt. We drive the firebox side first with a No. 60 or No. 80 air hammer, the bucking bar suspended on a rope cable on a pulley and a balanced weight. After each head is driven we cup the edge of the bolt head. My idea in applying bolts is that when tapping holes to keep the weight of the motor off the tap. We suspend our motors so that tap does not ride and make an elongated hole.

When we were having trouble with leaking staybolts we found we were getting oil into the boilers account of heater lines being piped off of a line receiving oil from the lubricator and the exhaust steam carrying it through the heater and back through the condensate line to the water tender. This has all been corrected. We also found that ashpit men were using water pumps around terminals while engines were standing.

The members of the committee are Dr. G. R. Greenslade (chairman), director of research, Flannery Bolt Co.; S. E. Christopherson (vice-chairman), supervisor of boiler inspection and maintenance, New York, New Haven & Hartford; W. H. East, regional boiler inspector, Baltimore & Ohio; S. S. McConnell, supervisor of boilers, and R. J. McNamara, general boiler shop foreman, Lima Locomotive Works.

Discussion

Most of the discussion of this report was concerned with the practice of seal welding staybolts, a procedure discussed at the 1945 and 1946 annual meetings and published on page 75, February, 1946, issue of the *Railway Mechanical Engineer*.

The Southern Pacific reported that this railroad has been seal welding staybolts for 18 months with very good results. It is putting mallet locomotives through the shop without renewing side sheets which, before seal welding, had to be removed after 11 months. The procedure used by this railroad is to run the staybolt 2 1/2 threads beyond the sheet and remove the threads by the use of a counterboring tool. Then the bolt is welded by using two passes, starting at the bottom of the bolt.

The Union Pacific reported getting 250,000 miles from side sheets by using seal welding. On this road it is believed necessary to drive the staybolts before welding. Also, a good fit and cleanliness are necessary. To remove the oil before welding the side sheet is painted with whiting and alcohol, left to dry for 12 hours, and then brushed off.

The Canadian Pacific reported using seal welding in test applications since 1944 with no side sheets having been removed since that time and this road is considering making a general application of this method.

In answer to a question about caulking after welding when hydrostatic tests show leakage, it was stated that caulking can be done to welded bolts but re-welding is not permitted.

Locomotive Men Consider Diesel and Shop Problems . . .

Reports Presented at the Meeting

*** Maintaining Diesel-Electric Locomotives**

*** Modernization of Steam Locomotive Repair Shops**

*** Report of Committee on Shop Tools**

Maintenance of Air Brake Equipment

Report of Welding Locomotive Parts

Report on Heat Treating and Forging

**** Reports indicated by asterisk appear in this section.***

The Locomotive Maintenance Officers' Meeting

Largest attendance since the organization of the association discusses reports on personnel, locomotive repairs and shops

S. O. Rentschler
President

There were 414 members and 29 guests registered at the fifth annual meeting of the Locomotive Maintenance Officers' Association held at the Hotel Sherman, Chicago, September 15, 16 and 17. Since the first meeting of this association after its reorganization from the former International Railway General Foremen's Association in 1939 the membership of the association has increased from the original 87 to over 1,300 members—active and associate—in 1947. No member meetings were held during the war years of 1942 to 1945, inclusive.

At the 1947 meeting the program consisted of the reports of eight committees and one address. The program was designed to appeal to a variety of interests and to men of all ranks in the mechanical department and was well balanced between reports dealing with the maintenance of both Diesel-electric and steam motive power and the problems of personnel training. There was a definite feeling, on the part of a substantial portion of the membership that, inasmuch as the Diesel-electric locomotive is occupying the attention of both mechanical and operating men, more time should be devoted to the technical and personnel problems relating to that type of power. As a result the proposed 1948 meeting will offer several new committee reports with this end in view.

On the second day of the meeting an address on the subject, "Man Power Versus Machine Power" was delivered by Roy V. Wright, editor, *Railway Mechanical Engineer*.

During the meeting eight committee reports were presented and discussed. The subjects and the chairman of the respective committees are: Maintenance of Air Brake Equipment, R. J. Dewsbury, assistant general air brake inspector, Chesapeake & Ohio; Maintaining Diesel-Electric Locomotives, T. T. Blickle, master mechanic, Atchison, Topeka & Santa Fe; Forging and Heat Treating, W. H. Ohnesorge, superintendent of shops, Boston & Maine; Training Understudies and Promoting Supervisors, H. J. Schulthess, chief of personnel, Denver & Rio Grande Western; Modernization of Steam Locomotive Repair Shops, T. J. Lyon, assistant to general superintendent of motive power, New York Central; The Supervisor Is Responsible for Safety, W. H. Roberts, superintendent of safety, Chicago & North Western; Shop Tools, H. H. Magill, superintendent locomotive and car shops, Chicago & North Western, and Welding, A. W. Johnson, supervisor of welding, Elgin, Joliet & Eastern. Committee reports appear in abstract in this article with the exception of the reports on personnel training and safety. These two were presented at a joint session of the Coordinated Mechanical Associations on Wednesday, September 17, and appear in the report of that joint session elsewhere in this issue.

Election of Officers

The following officers were elceted to serve for the 1947-1948 term: president, C. D. Allen, shop superintendent, Chesapeake & Ohio; first vice-president, J. W. Hawthorne, superintendent motive power, Central of Georgia; second vice-president, G. E. Bennett, superintendent motive power, Chicago & Eastern Illinois; third vice-president, P. H. Verd, superintendent motive power, Elgin, Joliet & Eastern, and secretary-treasurer, C. M. Lipscomb, assistant to production engineer, Missouri Pacific.

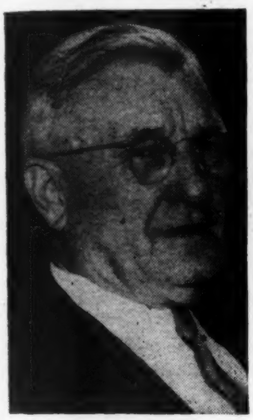
New members were elected to serve on the executive committee as follows: W. J. Crabbs, assistant chief motive power and equipment, Atlantic Coast Line; F. R. Denny, assistant mechanical superintendent, Texas & Pacific;

C. D. Allen

J. W. Hawthorne

G. E. Bennett

C. M. Lipscomb



O. A. Garber

F. K. Mitchell

C. B. Hitch

J. E. Goodwin

Locomotive Maintenance Officers' Association

1945-46

Officers

President: *S. O. Rentschler, general manager, Elgin, Joliet & Eastern Joliet, Ill.*

First Vice-President: *C. D. Allen, shop superintendent, Chesapeake & Ohio, Huntington, W. Va.*

Second Vice-President: *J. W. Hawthorne, superintendent motive power, Central of Georgia, Savannah, Ga.*

Third Vice-President: *G. W. Bennett, superintendent motive power, Chicago & Eastern Illinois, Danville, Ill.*

Secretary-Treasurer: *C. M. Lipscomb, assistant to production engineer, Missouri Pacific, North Little Rock, Ark.*

Advisory Committee

O. A. Garber, retired chief mechanical officer, Missouri Pacific.

F. K. Mitchell, general superintendent motive power and rolling stock, New York Central, New York.

C. B. Hitch, chief mechanical officer, Chesapeake & Ohio, Richmond, Va.

J. E. Goodwin, chief mechanical officer, Chicago & North Western, Chicago.

T. C. Shortt, chief mechanical officer, New York, Chicago & St. Louis, and S. O. Rentschler, general manager, Elgin, Joliet & Eastern.

New members who will serve on the Association's advisory board are: A. K. Galloway, general superintendent motive power and equipment, Baltimore & Ohio; L. R. Christy, chief mechanical officer, Missouri Pacific; L. E. Dix, mechanical superintendent, Texas & Pacific, and A. G. Kann, general superintendent equipment, Illinois Central.

Abstracts of several of the reports presented by the committees follow.

Report of Committee on Shop Tools

Increasing use of carbide tools for the machining of locomotive parts emphasizes need for modern machine tools of the proper design and of sufficient capacity

The committee, in analyzing the current trend in machine shop practices as applied to railroad maintenance, has found a decided shift in the proper conception of the way to remove metal from castings and forgings. Many jobs generally performed on shapers, planers and slotters are being shifted to milling machines, not only for the reason that metal can be removed faster, but also because the milling machine lends itself to the use of holding fixtures and indexing attachments that may be used to the following advantages: Positioning on rigid mounting; better dimensional control; better finish; and reduction in set-up time. Methods of attaining these advantages are shown in the accompanying illustrations.

On many railroads, the modernization of steam locomotive repair shops has been slowed up somewhat because the extent to which the Diesel-electric locomotive will replace the steam locomotive is not as yet clear. This being true, the committee feels that many economies can be made, and increased production secured, if a complete study is made of the existing machine tools in the plant, and the work placed in suitable fixtures and jigs on the proper machine.

H. H. Magill, Chairman

Carbide Milling

Before it is possible to discuss the subect of carbide milling in railroad shops, it is necessary to get some picture of carbide milling as it stands today. There is no phase of machining practice that is as unsettled as this one. Such a situation is, of course, understandable. The use of cemented carbides for milling is a recent development. While carbides have been used for this purpose for 10 to 12 years, it was only during the war that they were used to any great extent.

There is little agreement among the various milling cutter manufacturers, cemented carbide manufacturers, and the users, as to the proper angles involved, grades to be used and speeds and feeds required. Discussion and argument is going on over inserted blades, with brazed-on tips versus solid carbide blades, steel bodies versus cast iron and Meehanite bodies. What seems to do the job in one case is a complete failure in the next. At the moment, the only answer seems to be to engineer each application with consideration for the job itself, the equipment available, the personnel involved, and the economics of the situation.

Up to the present, the railroads have done little in the field of milling with cemented carbide cutters as compared with other industries. This is due to the unsettled state of the art itself, the lack of interest on the part of many of the milling cutter manufacturers, the inherent difficulties of railroad shop work with the consequent heavy expense involved in making up cutters which are only experimental, the lack of suitable machine tool equipment both for use and maintenance in most railroad shops, the lack of quantity production and the lack of appreciation of the economies possible with these cutters.

A few railroads have done some experimental work, principally on light motion work, shoes and wedges, and multiple guides; however, this committee has been unable to secure from railroads contacted any concrete data as to savings effected.

What Carbide Milling Requires

To take full advantage of the economies of carbide milling requires the improvement of all phases of the machining process; just substituting a carbide cutter for a high-speed steel cutter and speeding up the machine results in no economies at all. It is necessary to improve the machine tools themselves, the holding fixtures, grinding room practice, and materials handling as follows:

(a) Machine tools—it is necessary to provide milling machines designed for carbides with adequate horsepower and suitable speeds and feeds.

(b) Holding fixtures—it is necessary to provide fixtures which do two things—give adequate support to the work piece and give improved loading and unloading times. In connection with the last, *it is obvious that where the loading and unloading time consumes the major portion of the floor-to-floor time, under present practice,* no great labor cost economy can result by speeding up the actual machining time.

(c) Grinding practice—it is necessary to provide grinding

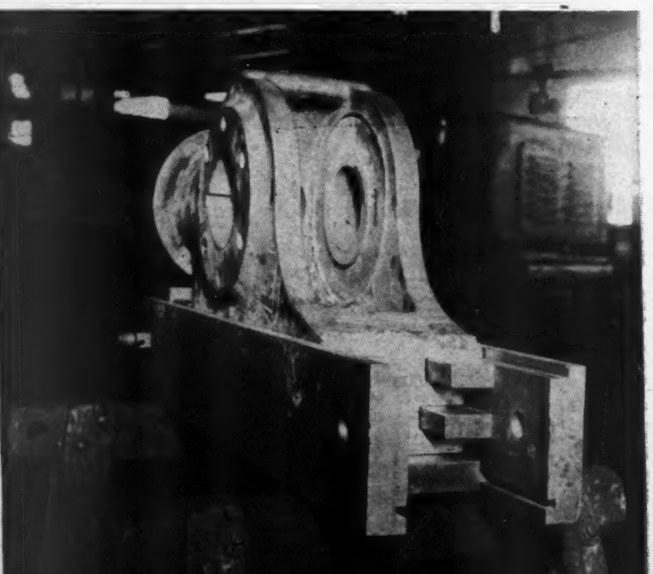


Fig. 1—Machining is eliminated by this fixture for babbiting multiple-wear crossheads to required size—The jig has four pieces bolted together, two side plates, a top surface plate and an end gate—The plates are tongued and grooved

equipment which is suitable for carbides. This involves accurate tool and cutter grinders and the *proper* grinding wheels. Grinding room personnel must be trained to handle carbides properly.

(d) Material handling—the speed improvement obtained in the machining time must be integrated with improvement in other phases. It does no good to improve floor-to-floor time if the machine must stand idle while new work pieces are hunted up in some other part of the shop. It is necessary to have a new load for the machine ready to take the place of finished work at once.

The Future of Carbide Milling

The use of carbide cutters for milling represents a large and practically untouched field for investigation and experiment. A few selected parts have been milled successfully up to now, but

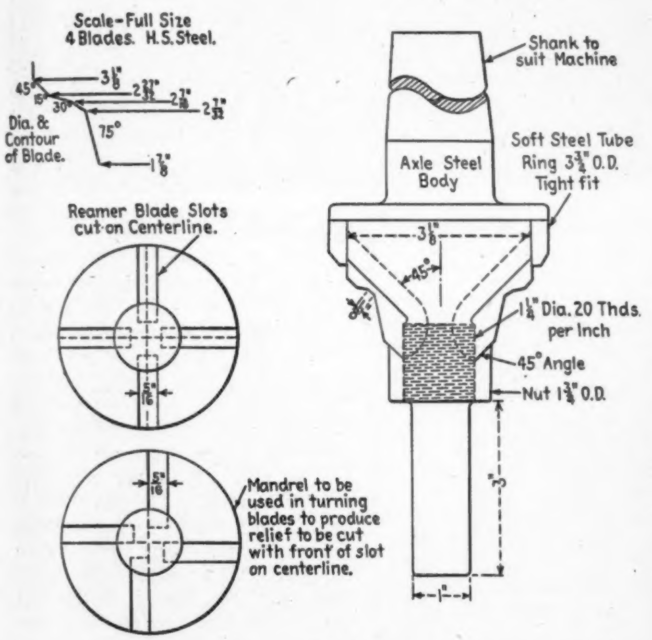


Fig. 2—Formed reamer for reconditioning worn exhaust valve seats on welded Diesel engine cylinder heads

given suitable machine tools and fixtures, 75 per cent of all railroad shop milling jobs can be handled economically under the present state of the art. Advancements in this field should improve this proportion to 90 per cent in a few years.

The economies resulting from using carbide milling cutters should be able to pay for the investment required in capital equipment in, at most, five years.

Recommendations

It is recommended that the introduction and use of carbide cutters proceed along the following lines:

1. Assign an individual or individuals whose duty will be to survey requirements, order tools, supervise or handle their manufacture and maintenance, set up the tools and instruct the operator in their use, follow up the performance and see that correct speeds and feeds are being used, and investigate and study tool failures and eliminate the cause. Large shops will probably require more than one man, while small shops can utilize a man part time only.
2. Order the necessary equipment for manufacturing and servicing carbides, such as grinders, chip breaker grinders, hones, etc.
3. Make a survey of the machines that carbides can be used on, listing shank sizes of tools and shapes.
4. Standardize on shank sizes and shapes as far as possible in order to reduce tool inventory and to facilitate the interchange of tools between machines.
5. All grinding of carbides should be done in a central department set up for that purpose and machine operators should not be permitted to grind carbides. An operator, part or full time on grinding carbides, is an increased cost; but offsetting this there will be a saving as individual mechanics will not have to grind their own tools.

Fig. 3—The center line of the frame is checked by a transit placed in the pit

Fig. 4—Two pieces of 2-in. pipe about 12-ft. long are used for marking reference points

6. Sufficient tools should be made up so that replacements will be available when required. There should be a minimum of two tools for each purpose on each machine, allowing for one at the machine and one in the tool crib. For tools requiring frequent grinding, three tools may be required for each purpose on each machine, although this can be reduced if the tool is a standard shape and size used on a number of machines.
7. Order suitable live centers for machines on which carbides are to be used for turning work on a center or centers.
8. In selecting jobs and machines for the application of carbides, choose the ones on which the greatest savings can be made on machine time with the least possibility of tool breakage. This helps to sell their use to the operators.
9. Do not attempt too many applications at one time. It is better to complete a few applications rather than have a large number of uncompleted ones that cannot be properly serviced.
10. Tables of work diameters and revolutions per minute to produce proper cutting speeds should be furnished operators

Table I—Machine Operation Data

art	Machine	Fixture	Type Cutter	Diameter, In.	No. of Teeth	R.P.M. Cutter, Tool or Drill	Feed, in. per min.	Tooth Lead, in.	Pieces per Grind	Depth of cut, in.	Tolerance	Size Drill, in.	Stroke Depth, in.	Type of Boring Tool	Chip Lead	Production Time, P hr.-min.-sec.	Former Method
Connecting rod front end brass	No. 4 plain-type milling	Indexing type	Inserted carbide-tippedblades (zero-zerorakeangle)	6	4	350	20	.015	200	⅛ to ¼	....	..	..	..	..	0-5-30[1]	High-speed steel inserted-blade cutter, 8 in. in diameter with 14 teeth at 41 r.p.m. and feed of 7¾ in. per min.—Tooth lead .012 in., 8 pieces per grind—floor-to-floor time 8½ min.
Bronze locomotive frame hoes	Three-spindle milling	Adjustable two piece	Solid body with brazed-on tips (rake angles 5-deg. positive axial and radial	10	12	300	30	.008	200	..	..	..	..	..	..	0-5-0[1]	Machined with carbide tools at the rate of one per hour
Bronze locomotive frame shoes	No. 3 plain hydraulic milling	Angle plate	......	7½	8	545	40	.009	150	1/16 to ⅜	.001 for thickness and straightness	..	..	..	..	0-3-0[1]	Machined with carbide tools on planer at the rate of two per hour
Bronze locomotive crosshead shoes	No. 5 Duplex Hydromatic milling	Special—See Fig. 7	Inserted-blade high-speed steel, shell type	4	10	127	18	.014	..	⅛ to ½	....	..	..	..	..	0-30-0[1]	High-speed tools on planer with same type fixture at the rate of one every two hours
Locomotive stay-bolts, drill and counter-sink	Automatic[2] drilling units	Two junior Airlox vices with special jaws	......	..	..	1750	..	....	..	..	....	1/16	1¾ max.	..	..	100 units per hour	Four-spindle drill press at the rate of 35 per hour
1-in. diameter bolts, drill cotter hole	Govro-Nelson automatic drilling unit	One Airlox vice with special jaws	......	..	..	....	..	....	..	..	..	⅝	..	..	..	160 units per hour	..
Valve gear frame	Boring and milling, rotary table	See Fig. 8	High-speed	..	..	....	..	....	..	..	..	..	..	Rexalloy	.	12-0-0[1]	Required two setups on planer, one on slotter, and one on horizontal boring bar—floor-to-floor time was 24 hours
Steel frame shoes for roller bearing locomotives	Vertical milling, for phosphorous bronze inserts	Simple adjustable	High-speed	..	..	....	3	....	35	⅛	..	..	..	..	..	1-0-0	Required four hours floor-to-floor time with planer
Steel boiler expansion pad	Boring and milling	Receiver type	High-speed slotting	10	..	....	1	....	..	⅛	..	..	..	..	..	4-0-0[1]	Slotter with no fixture—Required floor-to-floor time of ten hours
8½-in. Westinghouse air pump	Special two-way boring	Receiver type[3]	......	..	..	120	..	....	14	..	..	..	..	Carbide tip	.008	2-0-0[1]	Micro grinder, adjusting-screw fixture—Setup time was one hour and the floor-to-floor time was seven hours

[1] Floor-to-floor time.
[2] Model "H", ½ hp., 220-volt, 60-cycle, 3-phase motor. Adjustable stroke to 1¾-in., maximum drill capacity ⅜ in.
[3] Mounted on turntable. Dowels in steam cylinder located as shown in Fig. 6. Set up time is 30 minutes.

where necessary, as it is of major importance that each cutter tooth carry the proper chip lead not less than .008 in. for maximum tool life.

Other Shop Jobs

In some cases jigs may be developed to eliminate machining operations. The method of tinning multiple-wear crossheads where the jig shown in Fig. 1 is used consists first of all of sand blasting the crosshead and then placing it in a vat of muriatic acid for 20 minutes. Upon removal from the acid vat the acid is blown off and a coat of Satco flux is applied to the crosshead with a brush. The crosshead is placed in a pot of solder (50 per cent tin and 50 per cent lead) for 45 minutes at 600 deg. F. While the crosshead is in the solder pot the babbitting jig is heated to not less than 400, and up to 500, deg. F. The crosshead is then placed in the babbitting jig and the tin is poured at 600 deg. F.

Fig. 2 illustrates a formed reamer for reconditioning worn exhaust valve seats on welded Diesel engine cylinder heads which can be manufactured in any locomotive shop tool room. It has been thoroughly tried out and can be used on a vertical milling machine or a drill press with a saving in time of 75 per cent over the old method. The operation is as follows: Ream the valve guide hole to remove any scale which may have accumulated from welding; bore the throat of the seat with a four-blade counter-bore cutter with the pilot in the valve guide hole; rough the seat with the four-blade cutter, with the pilot in the valve guide hole at the approximate angle of the valve seat and clearance; and finish the valve seat and clearance with the formed reamer. The time required for the above four operations is 1 hour and 15 minutes.

With the old method, adjustable single point boring head tools were used. It was necessary to use four separate tools to obtain the various angles and a boring tool with four valve seats in each head for the throat. It was also necessary to indicate the position of each seat.

It took five hours to complete the operation using the old method. With the new method, which is self-centering, it is only necessary to tighten thumb nuts to hold the head on the machine.

Figures 3, 4 and 5 illustrate a method of squaring frames and obtaining main shoe sizes when laying out shoes and wedges on roller-bearing power with the use of transit. The fixture to which the transit is secured has a cross slide for adjustment and a vertical adjustment for height, as shown, as well as three level screws in

Fig. 5—A depth micrometer can be used to determine the thickness of the main shoes

the base for level adjustment. The procedure for performing this work by the use of a transit is as follows: (1) The engine frame is leveled; (2) One piece of 2-in. pipe, about 12-ft. long, is placed against the shoe faces of the front jaws and one against the wedge faces of the back jaws, and both pipes securely clamped. The center of the main frames is then established on both of these pipes. Plumb bobs are dropped from the center of the male center pin under the cylinders, from the center of the main trailer frame center casting, from the draw bar pin hole, and over the center of the chafing iron. If there are any frame castings to obstruct the view, a plumb bob is dropped from the centers on both pieces of pipe; (3) The transit is placed in the pit at the main jaws, the instrument leveled and a line is put on sight on the center line of the engine as located on both pieces of pipe.

Fig. 6—Fixture for lining up Westinghouse 8½-in. cross-compound air pumps to be bored

Then sight with the transit the location of the center pin draw bar pin holes and chafing iron to see if all are on the center line of the engine. Make a record of the necessary amount these are to be moved for correction. At this time, put a mark on the rear end of the extension frame in any convenient location so that measurements can be taken from the center line of the engine to the trailer rocket seats, as shown in Fig. 3; (4) The two pieces which were placed at the front and back jaws should extend at least 7 ft. beyond the outer side of the frame on one side. Use a rod tram and mark, from the center mark previously established as the center line of the engine, a distance approximately 6½ ft. from the outer face of the engine frame; (5) Remove the transit from the pit and level up the instrument on the floor about 3 in. back of the main-jaw shoe face in position so that the transit line of sight will pick up the marks made on the pipe front and back. (These are the marks carried from the center line of engine.) When these marks are picked up with the transit, turn the transit 90 deg. and draw a line over the main jaw, which will establish a permanent square line on this side of the frame. To scribe this line on the frame, drop an 18-in. scale down the jaw in proper location so that the transit vertical crosshair will track up and down the front edge of the scale. When this is done, scribe a line on the frame; *then, without moving the instrument,* follow the same procedure to locate the square line on the opposite frame. To check the square line on the instrument, again turn the transit 90 deg., and the line of sight should fall on the original line on the pipe. Before the instrument is changed, turn it back 90 degrees to the main jaw; depth micrometer readings can be taken to get the thickness of the main shoes. The method of doing this is to have a line turned on the thimble of the depth micrometer, which is adjusted to coincide with the vertical crosshair in the transit as shown in Fig. 5.

The approximate time for this operation is 2 hours.

The report was signed by H. H. Magill (chairman), superintendent locomotive and car shops, Chicago & North Western; W. K. Andrews, chief mechanical engineer, Kearney & Trecker Company; Bernard Cook, superintendent of shops, Norfolk & Western; E. A. Greame, tool room foreman, Delaware, Lackawanna & Western; J. H. McQuiddy, tool supervisor, Missouri Pacific; C. T. O'Connell, Kennemetal, Inc.; R. F. Stucker, shop engineer, Louisville & Nashville; J. E. Vanni, shop superintendent, Northern Pacific; A. Wallace, supervisor of tools, Texas & Pacific; and E. A. Wynne, mechanical engineer, Canadian National.

Fig. 7—Fixture for holding a locomotive crosshead while milling the shoes for the guide fit was composed of two extended V blocks, *A*, placed 21 in. apart, and bolted to the machine table with the center of the vee in the center of the table—The crosshead is mounted on a mandrel, *B*, having the same taper as the crosshead to be machined, and is secured on the fixture with two V-clamps—A T-block, *C*, which has adjustable screws to prevent the crosshead from moving sideways is mounted on the machine table—This block also has a stud in the top which is used with the clamp to hold the crosshead securely against four supporting jacks as shown in *A*, Fig. 4.

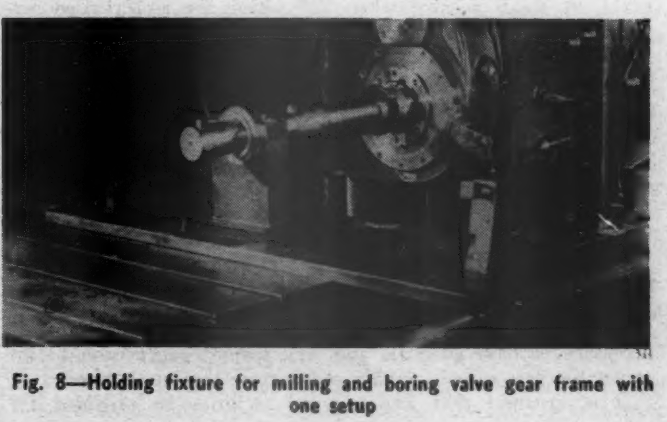


Fig. 8—Holding fixture for milling and boring valve gear frame with one setup

Maintaining Diesel-Electric Locomotives

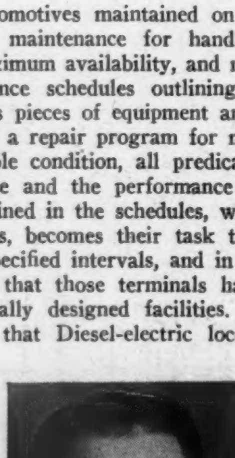
This type of locomotive has been in service long enough that controlling factors in repair methods and facilities are becoming apparent—Eleven roads report on practices

Diesel-electric locomotives maintained on a progressive basis utilizing preventive maintenance for handling normal repairs should result in maximum availability, and minimum repair cost.

Routine maintenance schedules outlining the repairs to be made on the various pieces of equipment and the frequency for doing so, establishes a repair program for maintaining the locomotives in serviceable condition, all predicated on the requirements of the service and the performance of the locomotives.

The work as outlined in the schedules, when assigned to certain repair terminals, becomes their task to perform upon the locomotive at the specified intervals, and in order to accomplish this it is necessary that those terminals have specially trained personnel and specially designed facilities.

Due to the fact that Diesel-electric locomotives use Diesel



T. T. Blickle,
Chairman

engines, steam generators, and many types of electric motors, generators and switch gear; it is very essential that the maintenance personnel be specialized on this work in order that they will become proficient and the locomotives will be properly maintained. The specializing of personnel on the various types of equipment can be accomplished by having shop supervisors attend classes of instruction conducted by the manufacturers of the equipment, or others familiar with it. When these persons have become proficient with the equipment they can be utilized to instruct others and supervise the work in the shop on the Diesel locomotives. It is also important that these persons acquire experience regarding the operation of the equipment on the road in order that they will know what is expected of it and how it must perform to meet the requirements of service. It has been said that one of the differences between the steam locomotive and the Diesel locomotive is the length of time it takes to make repairs when difficulties are experienced enroute—on the steam locomotive it generally takes only a short time to locate the trouble and a long time to fix it, whereas on the Diesel it takes a long time to locate the trouble and a short time to fix it. This has been true in the past with Diesel operation, and brings out the need of thorough training, both in the shop and on the road, of men to be utilized for trouble-shooting.

The manufacturers have literature covering the recommended operation and maintenance of the various pieces of equipment which is available upon request. This information is a valuable aid in maintaining the locomotive.

Expensive repairs and interruptions to service are caused by man-failure, and in order to reduce this to a minimum it is necessary to have adequate and well trained supervision to instruct the persons who repair and operate the locomotive.

It is essential that well-designed facilities be provided for Diesel locomotive repairs so that the work may be done efficiently, economically and properly. These facilities should include the necessary tools and layout to handle all work involved. Diesel locomotives cannot properly be maintained without them, and when it is necessary to do so it generally results in increased out-of-service time and difficulty in getting the job done right. Well designed Diesel maintenance facilities are also an important factor in reducing maintenance expense.

Directly related to the maintenance of the locomotive and having an important bearing upon it is their operation on the road. Proper handling is essential in order to obtain successful and economical performance, and minimize maintenance.

The Diesel locomotive operation involves many problems, some of which are peculiar to this type of power. Some of these problems are:

(1) Proper handling of the controls and equipment by the enginemen; (2) Training employees in the proper operation of the equipment; (3) Inspection of equipment enroute, or at intermediate terminals, especially on locomotives assigned to long runs; (4) Trouble-shooting and handling of emergency repairs at away-from-home terminals; (5) Application of proper tonnage ratings; (6) Train schedules; (7) Quality of fuel and water available; (8) Climatic conditions; (9) The coordination of performance reports and (10) Load factor and reliability.

Referring to the problem of proper handling of the controls and equipment by the enginemen, is it necessary to establish a standard procedure covering the recommended handling of the locomotive controls and equipment, and place these instructions into effect for the guidance of all concerned. This provides the necessary information for the correct handling of the equipment, and establishes a standard to work to. It is also necessary to issue instructions to cover minor trouble-shooting, such as proper handling of ground protective relays, replacing fuses, isolating power plants and other pieces of equipment. It is also essential that limitations be established covering the maximum allowable heating of the electrical equipment, minimum lubricating oil pressures, maximum cooling water temperatures and minimum cooling water levels for the guidance of all concerned, in order to protect the equipment. These limitations are very important, and expensive damage will result if they are not adhered to—such as overheated traction motors, generators, engines and scored crankshafts. These instructions, when conveniently located in the operating cab of the locomotive in condensed form can be readily referred to by the crew.

As to the training of employees in the proper operation of the equipment, this is one of the most important tasks confronting the Diesel operation. It involves the training of all supervisors, as well as the enginemen, and where Diesel locomotives are assigned to operate on long runs over several divisions, it involves training a considerable number of persons. Before any attempt is made to train enginemen it is essential to train supervision. This preliminary training can be accomplished by sending the supervisors to special schools coordinated at the manufacturers' plants, and by establishing special courses of instructions on the railroad, conducted by qualified instructors. The training of the enginemen can be accomplished by holding instruction classes at specified intervals, either in class rooms or specially constructed cars, plus-on-the-job instructions to be given on the locomotive. In order to bring about proper operation of the equipment, reduce delays to a minimum, and have men capable of remeding minor difficulties, it is necessary to establish an adequate educational program and perpetuate it to meet the needs of the future.

Inspection of Equipment Enroute

It is desirable to make periodic inspections of equipment while in operation to determine its performance, and pass this information on to the maintenance point. It is also necessary to make

inspection of the equipment at certain intermediate or turn-around terminals to insure that the locomotive is in proper condition to continue its run. These inspections should be made by qualified men if they are to produce the results for which they were intended. This means that these men must be trained for the job, and located where needed. In freight service members of the crew are able to make occasional checks of the equipment in the engine room while in operation, however, in the multiple-unit passenger service, the crew is required to remain in the operating cab while the train is in motion, which prevents them from checking the equipment in the engine room, except while the train is standing. The results is that Diesel-powered passenger locomotives do not receive as much attention enroute as those on freight trains, unless the locomotives are accompanied by additional personnel other than the regularly assigned engineman and fireman-helper. In passenger service, it is necessary that delays be eliminated, passengers be comfortable and trains arrive on time. In order to insure this more attention must be given passenger service equipment.

Handling Emergency Repairs

It has not been uncommon to do trouble-shooting and make emergency repairs at away-from-home terminals, and when these occasions turn up time is generally the most important factor. Trained personnel located at strategic terminals for handling this work is very essential for proper protection of the service. These men need not be only utilized for this work, but may be assigned on other work also, however, the important point is that properly trained men be available for trouble-shooting and emergency repairs when needed.

Tonnage Ratings and Train Schedules

Locomotive manufacturers have recommended tonnage ratings covering their locomotives, also limitations on minimum speeds at which the locomotives should be operated. These should be used as a yardstick for determining the maximum hauling capacity of the locomotive without damage to the equipment. Proper recognition of these limitations when establishing tonnage ratings is necessary in order to protect the electrical equipment from overheating, and when these limitations are exceeded it results in increased maintenance and expensive repairs.

Frequent stops result in high starting currents through traction motors and considerable cycling of the engine load—generally cycling the power plants between full load and idle, without much use of intermediate throttle positions in order to make schedules. Where there are few stops, the schedules are generally very fast, requiring full-load operation most of the time. In either case the engines receive rough service; this is reflected in the maintenance.

Fuel, Water and Climate

Past experience has proved that fuels having certain characteristics are detrimental resulting in excessive and expensive repairs. It is necessarry to have fuel that agrees with the engines using it. Water used in Diesel engine cooling systems and steam generators will cause excessive maintenance due to accumulations of foreign matters and pitting or corrosion, unless it is furnished free of solids and properly treated. Much has been done toward making prepared water available for cooling systems, and it is also necessary that water for steam generators receive similar attention.

Experience has indicated that climatic conditions have considerable bearing on the operation of Diesel-electric locomotives, and proper recognition must be given to it in order to eliminate grounds in electrical equipment, freezing and overheating of equipment. In dry climates there is no great difficulty with moisture grounds, however, in localities where there is considerable rain or snow it is necessary that the equipment be designed and and maintained to keep the moisture out of electrical equipment. In cold climates it is necessary that the engines be kept warm as well as other equipment subject to freezing. The steam generator on passenger power is one of the most important pieces of equipment on the locomotive. Extremely cold weather, or hot weather where steam-ejector air conditioning is used, places heavy loads on steam generators, resulting in increased maintenance. In hot climates, especially where high altitudes are attained, cooling systems get hot in the summer time and it is necessary that this be watched closely in order to prevent damage to the equipment.

Load Factors and Reliability

In the early stages of Diesel locomotive use, the load factor imposed was extremely high, resulting in heavy maintenance and decreased reliability. Experience has indicated that reduced load factors are more reliable, give better train performance and less maintenance. However, in order to attain this it is necessary to resort to locomotives of increased horsepower. At present there is a trend to locomotives of higher horsepowers, which is desirable.

Returns From a Questionnaire

In order to obtain up-to-date information on Diesel locomotive practices a questionnaire was sent out to several roads. The replies from 11 roads are included here and the answers were supplied by members of this committee from the roads indicated. The answers, in each case, appear under the same code numbers as the question. The questions follow:

1.—Describe training program for the following classes of men:
  a—Shop mechanics
  b—Shop supervisors
  c—Road supervisors:
    1—Road foremen
    2—Diesel supervisors
    3—Diesel Maintainers
  d—Enginemen and firemen-helpers

2—Describe methods of inspecting locomotives en-route. Who makes the inspection? How often? Furnish copy of inspection report and tell how these reports are sent to the home maintenance terminal and coordinated. (Note—Inspection report forms are not reproduced in this abstract—EDITOR)

3—How is trouble shooting handled in the road? Who makes the repairs and how is report handled so that all concerned at maintenance terminal will be fully informed?

4—Are Diesel road locomotives accompanied by specially trained personnel in addition to regular engine crew?

THE ALTON

1, a—Shop mechanics are instructed by supervision who have attended Diesel school and by service representatives of the builders.

1, b—Shop supervision attend the builders' Diesel school and receive further instructions from service representatives. Each general engine house foreman and some shop supervisors ride with builders' service men a number of trips to observe road operation.

1, c, 1—Road foremen of engines and mechanical inspectors receive the same training as the shop supervision.

1, c, 2—Traveling Diesel supervisors are not used.

1, c, 3—Diesel maintainers are not used.

1, d—Enginemen and firemen-helpers are instructed by road foremen who ride with them and take up each part of the operation manual with them, trip by trip until the road foreman feels that he can qualify the engineman. On locomotives where operation manuals are available the locomotive parts are identified by the part name painted on them and enginemen are instructed verbally by road foremen riding with them.

2—Passenger engines running between Chicago and St. Louis are not inspected enroute, except when standing, because of requirement that the fireman must not leave the cab when engine is enroute. Fireman inspects engine room when engine is standing. Enginemen and sometimes firemen inspect trucks, brakes, journal boxes, wheels, motor support bearings when engine is standing. On freight engines firemen inspect water level, and pressure, oil pressures and temperature, engine speed, air compressors, electrical contactors, etc., in engine room about every 15 to 25 minutes enroute. Engineer and/or fireman inspect trucks, journal boxes, wheels, traction motor support bearings and drains main reservoir while standing. Inspection reports are made out by engineer and left on engine for terminal maintenance force. Maintenance force enters work done in log book on engine. Maintenance points use the General Motors progressive maintenance chart.

3—Fireman does trouble-shooting, assisted by engineer, if locomotive is standing. Occasionally maintenance man from nearest

maintenance point rides engines in trouble. More often the multiple engine locomotives come to next nearest maintenance point with an engine shut down when trouble develops on the line. Trouble is reported on regular work report.

4—No specially trained persons accompany regular qualified engineer and fireman.

Atchison, Topeka & Santa Fe

1, a—Shop mechanics are trained for Diesel work by on-the-job instructions from their foreman and attendance at special instruction classes. Copies of manufacturers' instruction manuals and Santa Fe System Diesel folio of standard practices are available for their reference. Where conditions warrant it, men are specialized on certain types of work through special instructions from factory representatives.

1, b—Foremen assigned to supervise repairs on Diesel equipment, are men having previous experience as Diesel maintainers, shop mechanics on Diesel work, or as assistant supervisors of Diesel engines. These men secure special instructions through classes and from manufacturers' representatives. Instruction manuals and Santa Fe Diesel folios are available for their guidance. Monthly power meetings are conducted by division master mechanics at which time problems relating to Diesel maintenance and operation are discussed.

1, c, 1—Road foremen of engines are furnished instruction manuals covering the operation of the Diesel locomotives, and are given opportunity to attend schools established by the manufacturers. They work with the assistant supervisors of Diesel engines on their assigned territory, attend the Diesel power meetings and instruction classes held on their territory.

1, c, 2—*Diesel supervisors*—The following personnel are considered as Diesel supervisors: A supervisor of Diesel engines assigned on a system basis; assistant supervisors of Diesel engines assigned on a sytem or grand division basis and assistant supervisors of Diesel engines assigned on a division basis.

The supervisor of Diesel engines prepares instructions and follows up the general operation and maintenance of the Diesel locomotives, receiving his training through experience gained while working as an assistant supervisor on the system and division assignments, and as a Diesel maintainer on the road, and a mechanic in the shop.

The assistant supervisors of Diesel engines, who are assigned on a system or grand division basis, assist the supervisor in following up the general operation and maintenance of the Diesel locomotives. These men previously had experience as assistant supervisors on a division basis, Diesel maintainers on the road and mechanics in the shop. They are afforded the opportunity of working closely with the manufacturers in order to establish maintenance schedules, operating instructions, instruction classes and keep fully informed on developments and changes. The assistant supervisors of Diesel engines who are assigned on a division basis are selected from the ranks of the Diesel maintainers to instruct engine crews, inspect locomotives, and work with the road foreman of engines and other supervisors on their assigned territory. They are furnished copies of instruction manuals covering the operation and maintenance of the Diesel locomotives and are given opportunity to attend schools established by the manufacturers, instruction classes and power meetings conducted on their territory.

1, c, 3—Maintainers assigned to ride Diesel locomotives are generally selected from shop mechanics of the machinist or electrician crafts, who have served apprenticeship on the railroad. They are furnished copies of instruction manuals covering the operation and maintenance of the Diesel locomotives, and are assigned to the older types of passenger locomotives when used on long runs.

1, d—Enginemen and firemen-helpers receive on-the-job instructions from the assistant supervisors of Diesel engines and road foreman of engines and are accompanied by them until qualified. They are furnished with a copy of Santa Fe Diesel locomotive operating manual for their guidance, and attend special classes of instructions, which are conducted on each division periodically. Firemen taking examination for promotion are examined on Diesel locomotives as well as steam.

2—Diesel passenger locomotives on runs where maintainers are assigned are inspected enroute by the maintainer who accompanies the locomotive on its entire run.

Diesel passenger locomotives on runs where maintainers are not used are inspected enroute by assistant supervisors of Diesel engines or road foremen of engines on their respective divisions. The frequency of these inspections depends on the number of Diesel-powered trains being operated. Each locomotive is generally checked at a terminal, or accompanied a part of the way on each division by one of these men.

Diesel freight locomotives are inspected enroute by the fireman-helper periodically when not needed in the cab by the engineman. Assistant supervisors of Diesel engines and road foremen of engines also ride the locomotives periodically and make inspections. The frequency of which are determined by the number of Diesel-powered trains.

When inspections are made by assistant supervisors of Diesel engines or road foremen of engines, Santa Fe Form 1195-A Standard is made out, placed on the locomotive and accompanies the locomotive to its assigned maintenance terminal.

3—Minor trouble-shooting is handled enroute by the engine crew, except in cases where the locomotive is accompanied by Diesel maintainer, assistant supervisor of Diesel engines or road foreman of engines, in which case the crew is given assistance. At intermediate terminals trouble-shooting is handled by men from the shop or assistant supervisor of Diesel engines or road foreman of engines, and if necessary, the locomotive is accompanied and necessary information is passed ahead to the next terminal for their information and necessary handling. Information is entered on the locomotive inspection report and accompanies the locomotive to the maintenance terminal stating the repairs which were handled. in some cases supplemented by wire report.

4—Regularly assigned Diesel maintainers are used on the older locomotives which are operating on long runs.

Atlantic Coast Line

1, a—Diesel shop mechanics are from the ranks of the steam mechanics and are allowed to exercise their seniority when vacancies occur. No specialized program of training is employed, mechanics being furnished with copies of engine manuals and other literature furnished by the manufacturer of the equipment. Educational talking pictures are shown from time to time and special classes to shopmen are held after work hours during visits of the instruction car at terminals where shops are located. Other instructions are contained in letters which are placed in convenient bulletin books.

1, b—Shop supervisors are selected from the ranks of mechanics with Diesel experience and who show promise of developing into good supervisors. In addition to the material furnished mechanics, the foreman of each shop is a member of a system Diesel committee which meets bi-monthly, where problems relating to Diesel maintenance are freely discussed. From time to time shop supervision is given an opportunity to attend schooling at various manufacturers' plants.

1, c, 1—Road foremen of engines are furnished with operating manuals supplied by the various manufacturers and are given an opportunity to attend schools established by these manufacturers. Instruction letters, bulletins and other material relative to Diesel operation and maintenance, are also furnished to them periodically. They visit the instruction car and follow its activities while on their respective district.

1, c, 2—Diesel supervisors are recruited from the ranks of electricians of exceptional ability and are known as electrical supervisors. They receive similar training to that given the road foremen. Their basic training usually consists of several student trips with an experienced supervisor, after having been furnished with the necessary operating manuals and maintenance instructions. Following this training, the supervisor is required to pass an examination consisting of one hundred questions pertaining to Diesel operating and maintenance. They are required to participate in monthly questions and answers. These questions are not for the purpose of determining how much a supervisor knows, but rather to keep him mentally alert.

1, c, 3—Diesel maintainers are not used.

1, d—Enginemen making their initial trip on Diesel power are accompanied by road foremen. Thereafter he may make additional trips with an electrical supervisor, who will advise the road foreman when he considers the engineer qualified to handle this class of power. The road foreman will then make another trip before qualifying the engineer. Firemen-helpers may make qualifying trips with other qualified firemen-helpers,

electrical supervisor or road foreman will accompany the firemen-helper and give instructions in the operation of Diesel power. Both engineers and firemen-helpers are ridden with by either road foreman or electrical supervisors from time to time and their performance observed and additional instructions are given. They are furnished with operating manuals provided by the manufacturers and a copy of a booklet containing questions and answers on Diesel equipment. Educational bulletins are issued periodically and are posted in a special book available to the engine crews. The Diesel instruction car is used extensively in acquainting the crews with operation and road trouble-shooting.

2—On local non-supervised passenger trains and all freight power the fireman-helper makes periodic inspections of the engine room to determine that the equipment is operating properly. These inspections are required at least every 30 minutes, oftener if necessary. On through-line trains the fireman-helper must remain in the cab but is required to make an outbound inspection before leaving the terminal and must go back into the engine room at every stop, scheduled and non-scheduled. Spot electrical supervisors arrange to catch all non-supervised locomotives either at a terminal or enroute in order to assist in inspection and reporting of defects. Inspection reports are made out by the engine crews on the initial district and signed by subsequent crews and accompanies the locomotive to the final terminal. On regularly supervised trains a copy of this report is sent by the supervisor to the assistant chief of motive power. Road foremen and spot supervisors make out work report in duplicate which accompanies the locomotive if inbound to a maintenance point. If on the outward trip this copy is mailed to the maintenance point where it will be combined with the engine crew's report when the locomotive returns. The duplicate copy is mailed to the assistant chief of motive power.

3—The engineers are held responsible for delays or failures incurred while locomotive is in their care. Firemen-helpers work under the direction of the engineer and if it is possible trouble-shooting is carried on by the firemen-helper while the locomotive is under way. If the trouble is of such nature as to be beyond the knowledge of the engine crews they wire for assistance and an electrical supervisor or other trained man will meet the locomotive on arrival. Information concerning nature of trouble encountered is entered on the work report, which in turn reaches the maintenance point.

4—Three of our main line, through passenger trains are accompanied by specially trained men other than the engine crews. These trains are ridden by regularly assigned electrical supervisors the entire distance between Jacksonville, Fla., and Richmond, Va. Other trains have the benefit of spot supervision by the road foremen or spot electrical supervisors.

Chicago and North Western

1, a—Have no organized training program for Diesel machinists and electricians. All training has been acquired by experience on the job, with the assistance of the foremen and older men. However, we are planning to operate an on-the-job school from 8:00 to 10:00 a.m., and from 2:00 to 4:00 p.m., on a voluntary attendance basis. Instructions will be furnished both by our own Diesel department and by manufacturers' representatives.

1, b—Training is obtained by occasional attendance at the manufacturers' schools.

1, c, 1—Attendance at manufacturers' schools and contact with manufacturers' representatives.

1, c, 2—No orgainized training program for Diesel supervisors.

1, c, 3—Diesel Maintainers are not used.

1, d—The training of enginemen and firemen-helpers is accomplished principally by the road foremen. This is supplemented by a school car used over the entire system. The car is equipped with charts, movie projection equipment and a mock air brake set-up. The car is under the supervision of the general instructor, who was formerly an experienced road foreman of engines and also master mechanic.

2—Locomotives are inspected enroute by the engineer and fireman, who make their reports on the daily Diesel locomotive inspection report form. These reports stay with the locomotive until it arrives at its maintenance point where the foreman removes the form and assigns the necessary work.

3—Trouble-shooting enroute is generally handled by the fireman. The information is forwarded to the maintenance point on the work report form or, in the case of serious defects, by telegram. Occasionally, when unusual difficulties are reported, a qualified electrician or supervisor is assigned from the maintenance terminal to ride the locomotive in question.

4—Diesel road locomotives have only the engineer and fireman regularly assigned.

Elgin, Joliet & Eastern

1, a—Shop mechanics are trained by instruction books and the personal guidance of supervisors.

1, b—Shop supervisors are trained by instruction books and guidance of Diesel supervisors.

1, c, 1—Road foremen of engines are trained by instruction books; General Motors school, and instruction of Diesel supervisors.

1, c, 2—Diesel supervisors are trained by factory school; instruction books and factory servicemen.

1, c, 3—Diesel maintainers are not used.

1, d—Enginemen and firemen-helpers are trained by instruction book and instruction of road foremen of engines.

2—Have only one road locomotive, and our divisions are so short that we have set up no program of inspection enroute.

3—Trouble-shooting enroute is handled by calling out the nearest road foreman of engines or Diesel supervisor by the train dispatcher.

4—Road locomotives are not accompanied by any specially trained person in addition to the crew.

New York Central

a—*Shop Mechanics*: New mechanics are trained by working one new man with one experienced man until he is thoroughly familiar with the work. Apprentice training is also used.

b—Shop supervision at all points have been promoted from the ranks of men experienced on Diesel work (either mechanics or Diesel inspectors) and are instructed by Diesel supervisors and senior foremen.

1,c,1—Road foremen and assistant road foremen gain knowledge riding the locomotives with experienced Diesel supervisors and Diesel inspectors. They also spend time at maintenance shops.

1,c,2—Diesel supervisors are picked from supervisory ranks in the Diesel field. They get additional instructions at the various manufacturer's plants.

1,c,3—Diesel locomotive inspectors are picked from supervisors and other ranks having had considerable experience in either the Diesel or electrical field. They are trained at the maintenance shops. Further instruction is given riding locomotives with inspectors or supervisors. Diesel maintainers are not used.

1,d—Enginemen and firemen-helpers are given instructions in the instruction car and are instructed while on the locomotive by road foreman, assistant road foreman, Diesel inspectors and Diesel supervisors.

2—Locomotives are inspected enroute at several division points while crews are changing by Diesel locomotive inspectors. Defects noted are recorded in a log book carried on the locomotive so that maintenance point can make repairs. Serious defects are wired or phoned to general office, followed by written report copy of which is forwarded to maintenance shop.

3—Trouble-shooting is handled enroute by the Diesel locomotive inspector. If he is unable to locate the trouble and correct during the crew change period he rides locomotive and corrects condition if possible enroute. Any conditions found or repairs made are recorded in the log book and written report made to the General Office with copy to the maintenance point. When defective condition is not corrected wire or phone report is made to the general office.

4—Diesel road locomotives are not accompanied by specially trained personnel, except as noted above, or when green crews are being trained, or new locomotive is being inaugurated.

New Haven

1, a—In addition to training and experience already received, courses have been offered shop electricians and mechanics in Diesel electrical maintenance and Diesel mechanical maintenance. Classes are held for a period of two hours, each group meeting

twice a week at the completion of the day's work. Instructors are men who have been drawn from railway personnel, local school systems or men in allied industries. Instruction is based on the theory and practical application of the apparatus under discussion. Questions are answered by instructors or are settled by group discussion, making use of the blackboard, blueprints, text books, or manufacturers' publications. Apparatus, where practical, is demonstrated in the classroom, or where this is not possible, groups are taken to the equipment at shops or yards. Training aids have been provided, such as slides, sound slide films, and sound movie films. Lectures by manufacturers' representatives on the equipment under discussion are also given. Electrical course 80 hours. Mechanical course 72 hours.

1, b—*Shop Supervision*: A substantial number of shop supervisors who had limited or no contact with Diesel maintenance attended the classes given mechanics and electricians, as outlined in (a). In addition to this, assistant master mechanics, general foremen and foremen who will be responsible for the maintenance of new locomotives were sent to the manufacturers' plant for a five-day course on construction and maintenance. This course was divided between classroom work and shop instructions. At the same time locomotive construction was observed and a corresponding discussion on the maintenance of each part developed.

1, c, 1—Road foremen of engines are trained by representatives of the railroad and of the manufacturer while the locomotives are in revenue service and through personal instruction at terminals.

1, c, 2—Diesel supervisors correspond to Diesel inspectors on the New Haven. These men have had an opportunity to attend the manufacturers' schools along with shop supervisors.

1, c, 3—Diesel maintainers are not employed.

1, d—Enginemen and firemen-helpers are trained by road foremen while the locomotive is in operation, and in classes at terminals conducted by road foremen. Instruction is based on proper procedure and ways to keep road failures at a minimum.

2—Diesel locomotives are checked for performance enroute by road foremen of engines. No program of locomotive inspection is carried out enroute, as the longest run at the present time is only 157 miles. One road foreman follows Diesels exclusively, and is required to ride and check road passenger-freight Diesels once a month and make a report. This report is sent to the general road foreman of engines, superintendent of Diesel maintenance and the maintenance terminal responsible for the locomotive.

3—No trouble-shooting is done enroute. However, road foremen make written reports which are sent in as previously mentioned. In addition, when serious trouble is encountered enroute, direct phone calls are made to the maintenance terminal advising of the condition of the defective locomotive coming in.

4—Diesel locomotives are not accompanied by specially trained persons in addition to the engineer and fireman.

The report was signed by T. T. Blickle, master mechanic (chairman), Atchison, Topeka & Santa Fe; H. C. Taylor, Diesel superintendent, Southern System; F. Thomas, asst. to general supt. motive power, New York Central System; Paul H. Verd, supt. motive power & equipment, Elgin, Joliet & Eastern; E. J. Feasey, chief inspector of Diesel equipment, Canadian National; R. I. Fort, asst. research engineer, Illinois Central System; R. W. Murray, general supervisor of Diesels, Seaboard Air Line; H. D. Parker, general Diesel supervisor, Atlantic Coast Line; J. H. Whipple, Jr., supt. of Diesel equipment, Denver & Rio Grande Western; W. Prescott Miller, Diesel supervisor, Chicago & North Western; R. W. Seniff, engineer of tests, Alton; K. M. Darling, engineer of Diesel equipment, N. Y., N. H. & H., and F. G. Baker, electrical engineer, St. Louis, San Francisco.

Modernization of Steam Locomotive Repair Shops

Many roads are attempting to repair modern steam power in shops built many years ago which, except for the purchase of machine tool units, have not been modernized

Many railroads are attempting today to shop modern steam locomotives, built during the past eight or ten years in shops designed for the handling of locomotives built 25 or 30 years ago.

Except for the purchase of new and modern machine tools, in most cases nothing has been done to modernize the existing shops to permit efficient and economical handling of present-day large capacity locomotives.

During the war years the labor and material situation made improvements to buildings impossible. These conditions still exist to a certain extent.

Another more recent factor is the trend toward Dieselization of motive power. As a result of the indecision as to ultimate designs of motive power, management has, in most cases, delayed the modernization of shop facilities. Locomotives are now being repaired in shops so poorly suited to present day needs that excessive delays are common-place and unwarranted labor costs due to lack of proper facilities are accepted as a matter of course.

Although certain smaller roads, which are committed to eventual complete Dieselization, can ill-afford to modernize their present steam shops most larger systems have in operation locomotives purchased during the past one to ten years which give efficient and reliable service.

These locomotives, augmented by locomotives delivered in the last few months or now on order can be expected to remain in main-line service for the duration of their anticipated life at the time of purchase.

The performance of the latest type steam locomotives is such that minor changes in the production or supply of coal and oil can immediately reverse the economics which have produced the present **Diesel trend.**

To service locomotives of the types shown in Table I, and other modern power, efficiently and speedily, certain shop improvements or changes are required and can be justified from the investment standpoint.

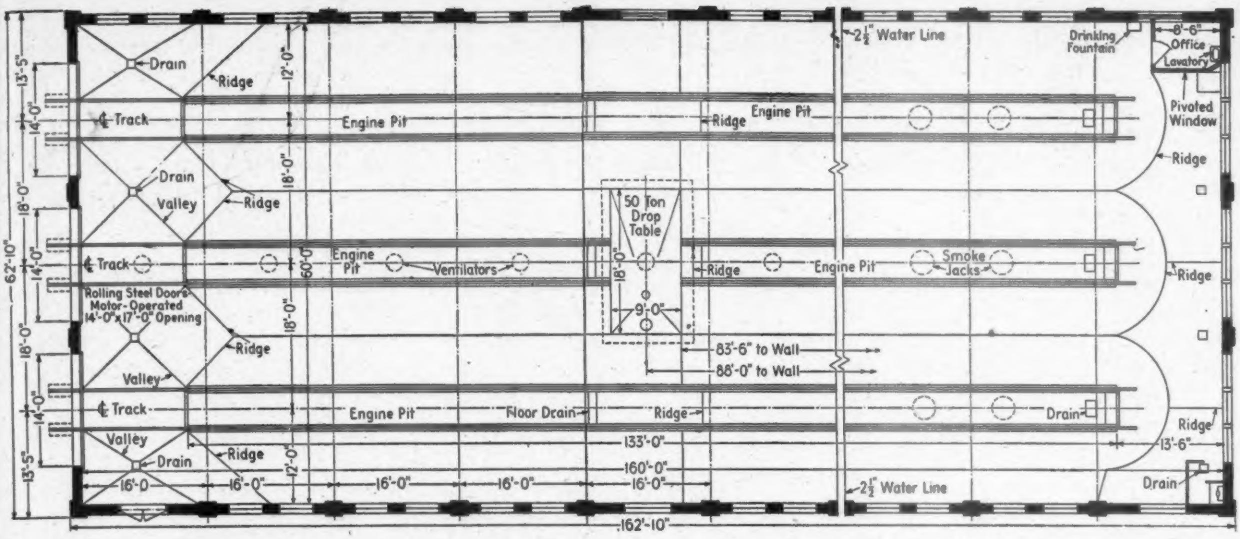
Before starting such a program it is necessary that a long range survey be made of possible types of motive power which may have to be shopped in the future, so that any improvements made to existing facilities can be readily used to their full extent regardless of the type of power purchased.

This report suggests a few items that are important in the shopping of modern motive power.

I—Facilities for Properly Lifting A Locomotive

We may assume that any future purchases of conventional steam locomotives will either duplicate the latest types now in operation or be locomotives of still larger capacities. These large capacity locomotives are needed not only to handle heavier trains but also to provide a modicum of reserve power not required under normal operating conditions but available for use under adverse fuel, mechanical and weather conditions to prevent train delays and locomotive cut-outs. As locomotives are now generally built to maximum height and width clearances the increased capacity can be obtained only by increased boiler pressure or additional length of the locomotive. This increased length with its attendant increase in weight will dictate crane requirements or other facilities designed to handle a locomotive.

In view of the fact that it is not possible, within the scope of this report, to go into detail, this committee included in the report several questions, with brief explanations as a basis of discussion.



Arrangement of facilities in modern finishing shed where locomotives are placed after leaving the backshop

Question: What will be the maximum length of locomotive to be operated on each railroad at any future time?

Question: Will the present span of crane runway support columns permit the handling of these locomotives?

In this connection it should be recognized that the removal of cab and pilots before lifting a locomotive will provide additional end clearances of from six to ten feet, dependent on locomotive design.

Question: What will be the total dead weight to be lifted?

It is usual, in this case, to consider the weight of the locomotive without water or sand, without trailer or engine trucks and without rods, but including the driving wheels and all locomotive auxiliaries as the minimum weight to be lifted. These weights are shown in Column 8 of Table I.

Question: Will present cranes handle the required load?

In lifting large locomotives the weight of which equals or exceeds slightly the full capacity of the overhead crane, it is interesting to note that while the total weight can be safely carried by the crane girders, the weight on the crane hoist or trolley over the front of the locomotive would often be excessive, if the usual smoke box and rear-of-frame hitches were made. In such cases the locomotive may still be safely handled by shifting the position of the lifting beam from under the extreme rear of the locomotive to a position further forward; thus transferring a portion of the load from the front to the rear hoist until the loads are equalized on each or within the safe handling capacities of either hoist. Due to the greater spread between crane trolleys in lifting positions, the bending moments on the crane bridge girders are often less, when handling the heavier locomotives of maximum length, than are experienced when lifting lighter, shorter locomotives.

Question: If the present crane capacity is insufficient can the girders be strengthened and new trolleys applied?

Question: Will the crane runway and support columns carry the total load of a reinforced or a new, larger crane plus its suspended load?

Question: Can an additional crane be placed on the runway and connected in tandem with present crane thus spreading the load on the runway and eliminating the necessity of reinforcing or renewing it?

When cranes are coupled in tandem the controls are synchronized and the loads are carried on beams attached to the main hooks of each crane. This method was used in at least one shop to provide 240-ton crane service in lieu of a former 120-ton operation.

Question: If a high-capacity crane, or other equivalent hoisting capacity, is required, should consideration be given to use of a locomotive hoist in lieu of the larger crane?

Pitless, six jack hoists, in capacities up to 460 tons, are now in use in several shops for handling small numbers of large locomotives, particularly those of the articulated and four-

Table I—Principal Weights and Dimensions of Modern Steam Locomotives

Type 1	Class 2	Road 3	Builder 4	Total Weight of Engine, lb. 5	Estimated Light Weight of Engine, lb. 6	Length Overall (Front of Coupler to Back of Cab Roof), ft.-in. 7	Light Weights Less Engine, and Trailer Trucks & Rods 8
2-8-4	8-Coupled	Nickel Plate Road	Alco	416,000	380,000	58–4½	343,500
2-10-2	Santa Fe	Reading	Baldwin	451,000	402,500	60–0	383,300
2-10-4		Atchison, Topeka & Santa Fe	Baldwin	545,260	486,000	70–5	448,300
2-10-4		Kansas City Southern	Lima	359,690	311,000	64–6	276,000
4-4-2	Atlantic	Chicago, Milwaukee, St. Paul & Pacific	Alco	290,000	259,000	53–2	226,300
4-6-2	Pacific	Pennsylvania		327,560	297,000	52–0	270,700
4-6-4	Hudson	Atchison, Topeka & Santa Fe	Baldwin	412,380	374,000	59–10½	329,000
4-6-4	Hudson	Chesapeake & Ohio	Baldwin	439,500	400,000	59–3	360,200
4-6-4	Hudson	New York Central	Alco	360,000	326,000	56–7⅝	286,200
4-8-2	Mohawk	New York Central	Lima	401,100	363,000	60–3½	336,000
4-8-4		Atlantic Coast Line	Baldwin	460,270	418,000	65–7½	372,500
4-8-4		Chesapeake & Ohio	Lima	503,500	456,500	64–2½	411,000
4-8-4		Chicago, Milwaukee, St. Paul & Pacific	Baldwin	493,550	447,500	66–0	402,000
4-8-4	T-1	Reading	Co. Shops	441,300	403,200	62–5½	346,000
4-8-4	Niagara	New York Central	Alco	471,000	423,900	66–2	378,400
4-4-4-4		Pennsylvania	Baldwin	497,200	451,000	68–5	404,000
4-4-4-4		Baltimore & Ohio	Co. Shops	391,550	358,500	63–3¼	311,500
2-6-6-6		Chesapeake & Ohio	Lima	724,500	665,000	81–2½	615,000
4-6-6-4		Denver & Rio Grande Western	Baldwin	641,700	587,000	77–0½	536,000
4-6-6-4		Western Maryland	Baldwin	601,000	542,000	76–8	491,000
2-8-8-4		Baltimore & Ohio	Baldwin	628,700	577,000	82–1½	536,500
4-8-8-4		Union Pacific	Alco	762,000	700,000	87–10	651,000

cylinder types. These jacks offer an economical method of handling a small number of large locomotives as compared to the cost of purchasing and installing high-capacity cranes of excessive length of span.

It should also be remembered that the large cranes operate much slower than those of medium size. This could result in a substantial loss in manhours. The proportion of large and small locomotives to be shopped will materially affect the type of lifting device purchased.

> *Question*: Should consideration be given to alterations to an existing transverse type shop to provide a longitudinal section thus making a so-called combination shop?

It is well to consider that in a properly designed longitudinal section of a shop it would be possible and practical to handle steam or gas-turbine locomotives as well as Diesel locomotives if desired.

Under Item II there is a discussion of the use of one or more drop tables in the locomotive shop. Too long have drop tables been considered as an engine terminal or car shop tool not suitable for or required in locomotive shops.

II—Drop Table in the Back Shop

The drop table is a necessity today in any up-to-date locomotive shop. With suitably designed and located tables, engine and trailer trucks can be easily disconnected and removed from locomotives, permitting the ready application of lifting beams and cables for the further handling of the locomotive by the overhead crane. This process is, of course, reversed after wheeling of the locomotive, the trucks being easily and safely connected by means of the drop tables.

Prompt and easy removal of one or more pairs of drivers without the necessity of disconnecting the tender and stripping the locomotive for application of crane slings can be accomplished on locomotives sent to the shop for unclassified repairs due to defective roller bearing wheel assemblies, cut journals, broken frames and other similar causes.

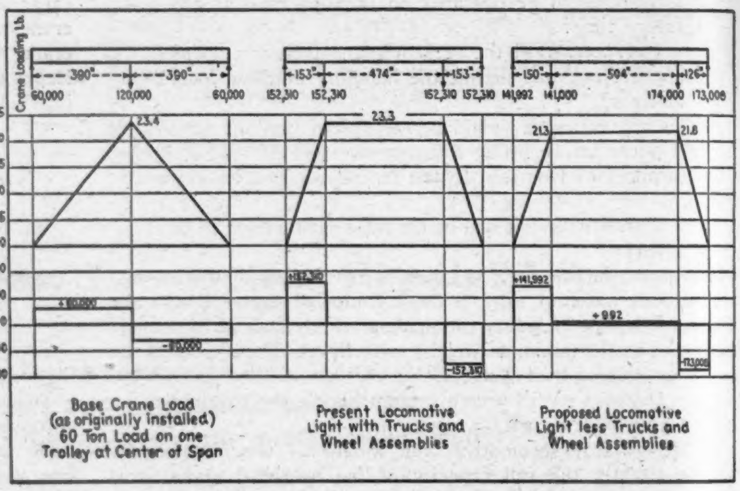
The savings in man-hours used to apply or remove the trucks from one or more locomotives daily will readily pay off the investment in a drop table. The space required to install such a table can be found in nearly all shops. If desired, the shop table could also be used to exchange power trucks under electric and Diesel road locomotives and switchers.

Another use of a stationary type drop table is in the inspection or fire-up shed where locomotives are made ready for trial runs or despatchment.

Most shop men are familiar with the man-hours lost in blocking and jacking fired-up locomotives in the inspection shed, before or after the break-in runs, for the purpose of leveling spring rigging and equalizers, adjusting the engine and tender deck heights and drawbar heights.

The use of a standard 10-ft. long table top on a 50-ton capacity table which will raise to a height of four inches over the rail and lower to four ft. below the level of the rail will permit the up-and-down movement of each individual wheel or truck in the locomotive to check proposed changes in spring or engine alignment and the rapid accomplishment of desired changes when decided upon.

One mechanic, either alone or with a helper, will accomplish more in an hour using a table of this type than will four men in an eight-hour day by present methods. The investment required is small and the returns will be large.



Typical bending moment diagram showing effect of various loadings on crane girders

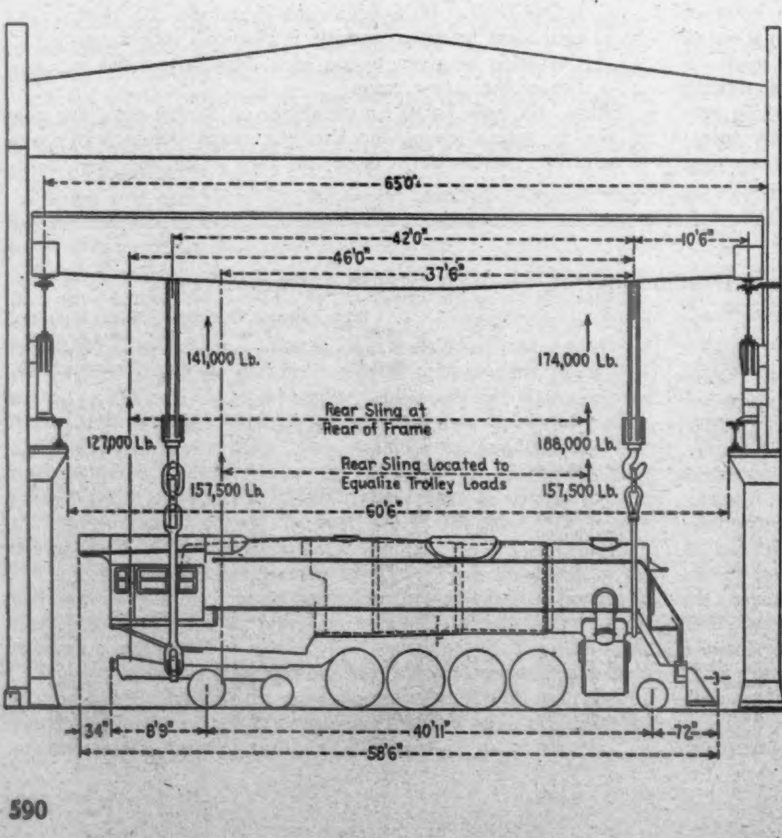


Diagram showing crane loads with slings at various locations

III—Special Department for Roller Bearing Wheel Work

It is the opinion of the committee that special consideration should be given to the establishment of a roller bearing driving wheel set-up in the shop. Nearly all modern locomotives have roller-bearing driving boxes and axle assemblies.

Roller bearing work requires cleanliness, special cleaning facilities, benches for inspection of bearing parts and special press facilities. Exact quartering of wheels is required and the tolerances sometimes permitted on friction bearing work cannot be allowed on roller bearing equipment.

Two 120-ton cranes in existing shop operated together by means of synchronized controls to afford 240-ton capacity

Wherever possible use should be made of a separate press for roller bearing driving wheel work in order to prevent delays due to the continual changing or press resistance beam blocks when the press is used for both friction bearing and roller bearing wheels. Where only locomotive work is involved consideration should be given to the establishment of a separate roller bearing department to handle engine truck, trailer and tender wheels equipped with roller bearings. This will permit the use of a minimum number of specialties on roller bearing work and tend to produce better workmanship on bearing inspection and assembly.

In arranging for a roller bearing department, consideration should be given to joint use of the tire and wheel turning lathes to prevent unnecessary moving of material.

Where car and locomotive shops are located on adjacent property, a joint wheel shop can be set up to handle all car and tender wheels (both cast iron and steel) and all rolled-steel locomotive trailer wheels which can be handled in a car wheel lathe. This shop should be equipped to handle both friction and roller bearing wheels and wheels for air conditioned cars having gear or special axle drives.

IV—Cleaning Locomotives Before Moving To Shop for Repairs

It was formerly the practice at many shops to sand blast locomotive front ends, wheel centers, cabs, parts of the frame, etc. This work was done either in a specially-built sand blast house or out of doors.

Locomotives with roller bearings are by-passed around the sand blast and placed on a pit or in the stripping shed without cleaning, this to the great disgust of the strippers or mechanics that are forced to work on that locomotive.

Good labor relations in the stripping department—which can be and often is the bottle neck of shop operations—can best be established by giving the stripping gang clean locomotives to work on. This assures speed and safety.

The use of Alemite or soft grease lubrication on locomotives having needle type valve gear bearings and roller bearing side and main rods has resulted in locomotives coming in covered with a dirt-contaminated greasy coating from the rear of the cylinders to the front of the firebox; on the sides and tops of the frames; on the waist sheets and on the undersides of running boards, brackets and boiler jackets.

Washing locomotives in daily service for appearance sake or for inspection purposes serves only to improve the looks of the locomotive. It does not clean the parts so that they may be easily and safely removed or handled.

There are in existence two or more installations where locomotives are placed within a metal building or enclosure for cleaning, which is accomplished by streams of water and cleaning solutions directed from a multiplicity of nozzles and supplied by solution re-circulating pumps.

Whether or not such installations can be justified from an investment standpoint should be the subject of careful study.

The committee does not have sufficient information as to first costs, operating expenditures or results obtained to offer an opinion on these cleaning facilities.

Ample cleaning can be accomplished by means of a steam-jet activated stream of hot water containing any one of several cleaning solutions and directed through a suitable pipe and nozzle. A mixture of hot water and cleaning solution furnished under pressure by steam or electric driven pumps is also effective and may be employed where washout systems are available.

Certain patented devices are on the market to provide mixtures of steam, water and chemical solvents under pressure which also can be used effectively.

The operator who cleans a locomotive by this means should be provided with protective clothing, and proper platforms and drainage should be arranged to permit a thorough job of cleaning.

V—Material Handling in the Shops

All too often shops are operated with worn out, out-moded, material-handling equipment, including hand trucks.

Trucking is done over uneven and worn bricked or planked floors and on packed down earth passageways between buildings.

The efficient handling of material is a necessity in view of present and prospective wage rates for helpers and laborers. Shops should be laid out with well marked passageways or lanes and cement or concrete runways provided outside of the buildings to furnish easy access to all locations concerned with shop operations and storage of materials.

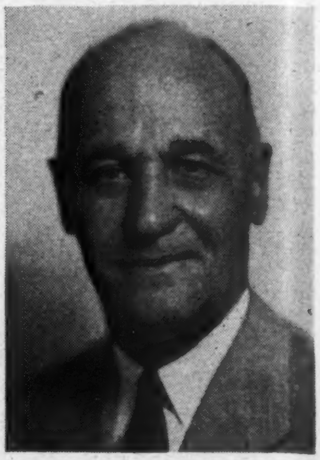
Many types of modern material-handling equipment such as gasoline engine or battery-operated, lift trucks, fork trucks, tractors, crane trucks and delivery trucks are now used to simplify shop work and the "right-or-way" over which this mobile equipment operates should be modernized if full advantage of their potential economies is to be realized.

The report was signed by T. J. Lyon, chairman, assistant to general superintendent motive power, New York Central System, New York; R. H. Herman, engineer shops and equipment, Southern Railway System, Washington 13, D. C.; H. Hotaling, New York Central System, Buffalo 12, N. Y.; I. W. Martin, locomotive shop superintendent, New York Central Railroad, West Albany, N. Y.; F. B. Rykoskey, supervisor of shops, Baltimore & Ohio Railroad System, Baltimore 1, Md.; E. Wynne, mechanical engineer, shop methods, Canadian National System, Montreal, Quebec; and H. C. Wilcox, editor, Shop Section, *Locomotive Cyclopedia* and associate editor, *Railway Mechanical Engineer* and *Railway Age*, New York.

Supply Exhibit at Chicago Convention

M. K. Tate,
President

Allied Railway Supply Association exhibit of 96 member companies replete with locomotive, car and shop devices



C. F. Weil,
Sec.-Treas.

In connection with the annual meeting of the Coordinated Mechanical Associations, at the Hotel Sherman, Chicago, the exhibit of the Allied Railway Supply Association was made up of the locomotive, car and shop equipment devices representing 96 member companies of the Association. The list of the companies exhibiting appears below.

The following officers and directors of the Allied Railway Supply Association were elected:

Officers: president, E. H. Weaver, Westinghouse Air Brake Co.; first vice-president, Bradley S. Johnson, W. H. Miner Co.; second vice-president, W. C. Sanders, Timken Roller Bearing Co.; third vice-president, R. A. Carr, Dearborn Chemical Co.; fourth vice-president, C. O. Janista, Barco Manufacturing Co.; fifth vice-president, W. T. Lane, Franklin Railway Supply Co.; secretary-treasurer, C. F. Weil, American Brake Shoe Co.

Directors: John Baker, Locomotive Firebox Co.; V. E. McCoy, National Aluminate Co.; George T. Badger, Paxton-Mitchell Co.; S. W. Hickey, Simmons-Boardman Publishing Corp.; John S. Dixon, Lima Locomotive Works; H. C. Hallberg, Waugh Equipment Co.; George Green, American Locomotive Co.; Bard Browne, Superheater Co.; C. R. Busch, Unit Truck Corp.; F. E. Moffett, National Malleable and Steel Castings Co.; F. Rutherford, Vapor Car Heating Co.; J. L. Smith, New York Air Brake Co. and J. A. MacLean, MacLean-Fogg Lock Nut Co.

Exhibitors

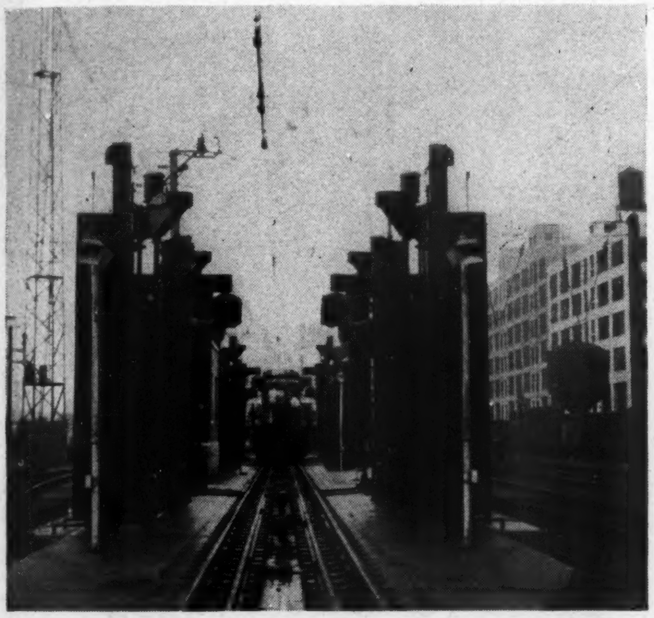
Air Reduction Sales Co., New York 17.
Adjuster Co.
Ajax-Consolidated Co., Chicago 24.
American Arch Co., New York 17.
American K.A.T. Corp., New York.
American Locomotive Co., New York 7.
American Steel Foundries, Chicago 11.
American Welding & Mfg. Co., Warren, Ohio.
Apex Machine & Tool Co., Dayton 2, Ohio.
Arrow Tools, Inc., Chicago.
Badeker Manufacturing Co., Chicago 12.
Barco Manufacturing Co., Chicago 40.
Brickseal Refractory Co., Hoboken, N. J.
Buckeye Steel Castings Co., Columbus 7, Ohio.
Cardwell-Westinghouse Co., Chicago 4.
Champion Transportation Sales, Inc., Chicago.
Chemical Appliance, Inc.
Chicago Freight Car Parts Co., Chicago 1.
Chicago Pneumatic Tool Co., New York 17.
Chicago Railway Equipment Co., Chicago 9.
Dampney Co. of America, Boston, Mass.
Dearborn Chemical Co., Chicago 4.
Detroit Lubricator Co., Detroit 8, Mich.
Enterprise Railway Equipment Co., Chicago 5.
Eutectic Welding Alloys Corp., New York 13.
Ewald Iron Co., Louisville, Ky.
Fairbanks, Morse & Co., Chicago 5.
Flannery Bolt Co., Bridgeville, Pa.
Franklin Railway Supply Co., New York 17.
Garlock Packing Co., Palmyra, N. Y.
Great Lakes Steel Corp., Ecorse, Mich.
Hanna Stoker Co., Cincinnati 27, Ohio.
Holland Co., Chicago 4.
Hollup Corp. Div., National Cylinder Gas Corp., Chicago 50.
Hulson Grate Co., Keokuk, Iowa.
Hunt-Spiller Manufacturing Corp., Boston, Mass.
Hyster Truck Co., Portland 8, Ore.
Independent Tool Co., Chicago 6.
Ingersoll-Rand Co., New York 4.
International Metallic Packing Corp.
Iron & Steel Products, Inc., Chicago 33.
Johns-Manville Corp., New York 16.
Leslie Co., Lyndhurst, N. J.
Lima Locomotive Works, Lima, Ohio.
Locomotive Finished Material Co., Atchison 1, Kan.
Locomotive Firebox Co., Chicago 4.
Lunkenheimer Co., Cincinnati 14, Ohio.
MacLean-Fogg Nut Co., Chicago 39.
Magnaflux Corp., Chicago 31.
Magnus Brass Manufacturing Co., Cincinnati 2, Ohio.
Manning, Maxwell & Moore, Inc., Bridgeport 2, Conn.
Miller Felpax Co., Winona, Minn
Miller Waste Mills, Inc., Winona, Minn.
Miner, W. H., Inc., Chicago 4.
Modern Railroads (magazine), Chicago 6.
Monarch Packing Co., Chicago.
Monroe Auto Equipment Co., Monroe, Mich.
Nathan Manufacturing Co., New York 29.
National Aluminate Corp., Chicago 38.
National Malleable & Steel Castings Co., Cleveland 6, Ohio.
New York Air Brake Co., New York 17.
Oakite Products, Inc., New York 6.
Oil-Dri Corp. of America.
Okadee Co., Chicago 4.
Oxi Corp., Gary, Ind.
Oxweld Railroad Service Co., Chicago 1.
Paxton-Mitchell Co., Omaha 5, Neb.
Pilliod Co., New York 7.
Railroad Equipment (magazine), New York 7.
Railway Equipment & Publication Co., New York.
Railway Purchases & Stores, Chicago.
Railway Service & Supply Corp., Indianapolis 7, Ind.
Republic Steel Corp., Cleveland 1, Ohio.
Sargent Co., Chicago 13.
Shanahan, R. S., Co.
Simmons-Boardman Publishing Corp., New York 7.
Sinkler, Joseph, Inc., Chicago 3.
Snap-on Tools Corp., Kenosha, Wis.
Spring Packing Corp., Chicago 3.
Standard Car Truck Co., Chicago 4.
Standard Stoker Co., New York 17.
Superheater Co., New York 17.
Superior Hand Brake Co., Chicago.
Swanson, O. W., Co., Chicago 25.
Thulin, E. E., Co.
Timken Roller Bearing Co., Canton 6, Ohio.
Trimont Manufacturing Co., Boston 19, Mass.
T-Z Railway Equipment Co., Chicago 3.
U. S. Metallic Packing Co., Philadelphia 23, Pa.
Union Asbestos & Rubber Co., Chicago 4.
Unit Truck Co., New York 6.
Universal Railway Devices Co., Chicago 4.
Valve Pilot Corp., New York 17.
Van Der Horst Corp. of America, Olean, N. Y.
Vapor Car Heating Co., Chicago 4.
Viloco Railway Equipment Co., Chicago 4.
Watson-Stillman Co., Roselle, N. J.
Waugh Equipment Co., New York 17.
Westinghouse Air Brake Co., Wilmerding, Pa.
Whiting Corp., Harvey, Ill.
Wilson Engineering Corp., Chicago 3.
Wine Railway Appliance Co., Toledo 9, Ohio.
Worthington Pump & Machinery Corp., Harrison, N. J.

Non-Exhibiting Members

American Car & Foundry Co., New York 7.
Baldwin Locomotive Works, Philadelphia 42, Pa.
Detroit Graphite Co., Detroit 16.
General Refractories Co., Philadelphia 7, Pa.
Griffin Wheel Co., Chicago 11.
Huron Manufacturing Co., Detroit 7.
Lehon Co., Chicago 9.
Magnus Metal Corp., New York 6.
Pyle-National Co., Chicago 51.
Standard Railway Equipment Co., Chicago 4.
Texas Co., New York.

ELECTRICAL SECTION

Electric Locomotive Washer



The front and rear ends of the locomotives are washed by hand just before the locomotive is sent through the washer

The Pennsylvania has installed a semi-automatic washing machine for electric locomotives at its Sunnyside yards in New York. It incorporates a number of features including those required for this specific application. It is designed to wash 100 locomotives in 24 hours, each washing requiring 15 minutes as compared with 55 minutes for doing the work by hand. Its primary purpose is to allow the locomotives to be returned to service more quickly and it is expected that by permitting more frequent and more thorough cleaning, it will reduce the amount of repairs and replacements required.

The washer, which is about 300 ft. long, is built in two sections, one for washing and the other for rinsing. Washing solution and water are applied by sprays, and motor-driven, vertical and horizontal rotating brushes on each side scrub the sides of the locomotive as it passes through the washer. All brushes are hinged and the horizontal brushes which scrub the upper curved surfaces can be moved vertically. An operator stationed between the washer and the rinser has complete control of the sprays and the movement of the brushes.

A locomotive to be washed is brought to the washer on its own power as received from the 12,000-volt overhead contact wire. The section of the contact wire over the washer is insulated from the live section and is grounded. The rear pantograph is used to bring the locomotive partly under the grounded section, and at this position the locomotive has passed over a cable-drawn "barney" in a pit. Also at this position, there are hinged, curved platforms which are swung out around each end of the locomotive and from which the ends of the locomotive are washed by hand. This work is facilitated by long-handled brushes attached to hoses.

When the ends are washed, the hinged platforms are swung aside and the "barney" is drawn up out of its pit to push against the rear coupler of the locomotive. It has four wheels running on a narrow gauge track between the full-gauge track and is drawn back and forth by a 50-hp. reversible motor which drives a loop of cable connected to the "barney." Both pantographs are down as the locomotive is pushed slowly through the washer.

If it is required by the locomotive condition, a solution of oxalic acid is used for washing. If it is not very dirty, only cold water is used. After proceeding through the washer, and just before reaching the rinsing machine, 4 two-jet rotating nozzles project streams of 180-deg. F. water against the sides of the running gear. Cold water only is used in the rinsing machine. In its final position as moved by the "barney," the forward pantograph is under a live trolley so that the locomotive may proceed under its own power.

The "barney" comes out of its pit to push a locomotive through the washer

The flow of washing solution and rinsing water and the movement of brushes are controlled from a central position

The machine was designed and built by the Whiting Corporation, Harvey, Ill., in cooperation with engineers of the Pennsylvania's motive power department. It was erected by the New York Division Master Mechanic's forces.

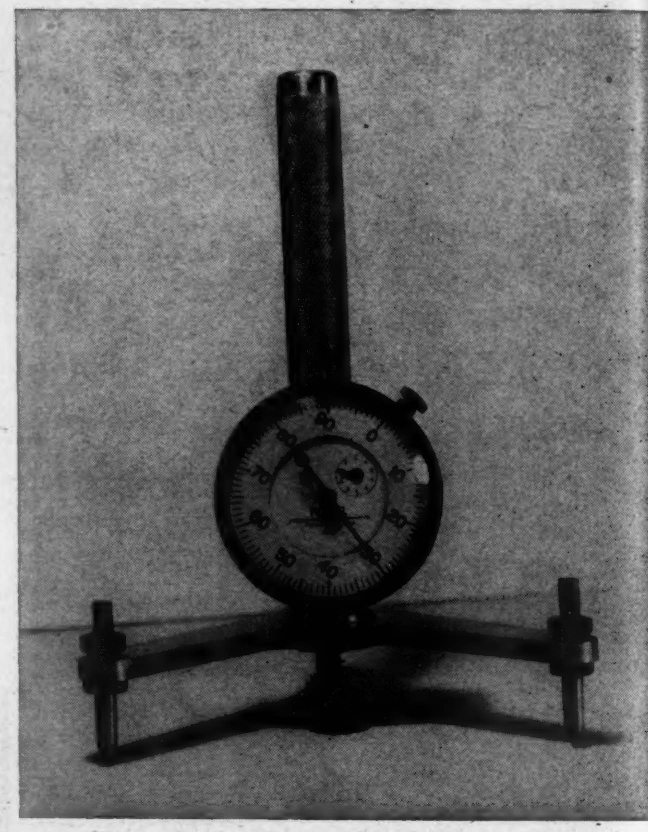
Pinion Advance Indicator

It is common practice to secure pinions to traction-motor shafts by shrinking a hot pinion on the end of a cold-shaft. The pinion and the shaft have taper fits and after the pinion is applied, it is secured in place by a nut which is drawn up on a threaded end of the motor shaft. The pinion is first applied cold and its longitudinal position with respect to the shaft is measured and recorded. It is then heated and again applied. Since the heating causes the pinion to expand, it can be slipped farther up, or advanced on the shaft taper when it is hot. It is important that the amount of advance be exact. If it is too much, the shrinkage force may result in breaking the pinion, and if it is not enough, the pinion may work loose when the motor is under load.

The device shown in the illustration was made to assure an exact measurement of the amount of advance. It consists of a Federal one-inch-reach dial indicator applied to an adjustable tripod. The three points of the tripod engage the face of the motor pinion and the ball end of the gauge is applied to the shaft center.

The first operation in applying a pinion is to use go and no-go gauges to determine the correct size of the pinion and shaft. Chalk or Prussian blue is then used to coat the shaft taper and the pinion is applied to the shaft fit. The pinion must show a 75 per cent fit; that is, at least 75 per cent of the chalk must be scraped when the pinion is turned on the shaft. Pinions are not used if the fit is less than 75 per cent.

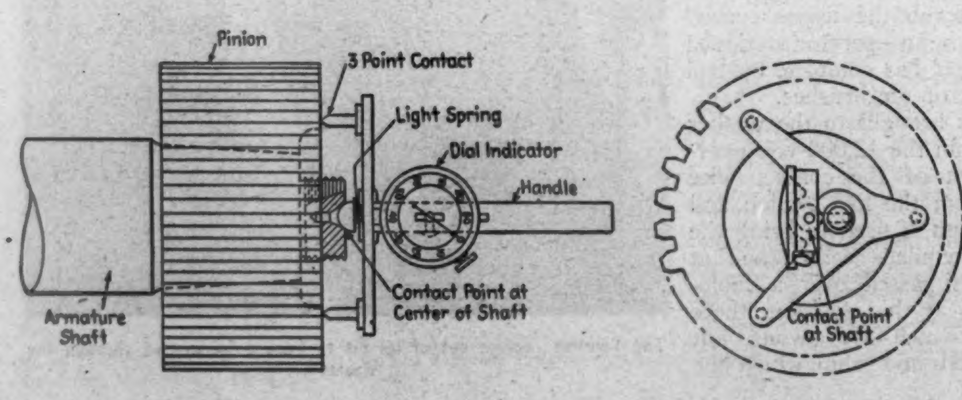
The pinion is then again applied cold and a reading taken with the pinion advance indicator. The reading is



The device measures advance accurately and shows the amount plainly on a large dial

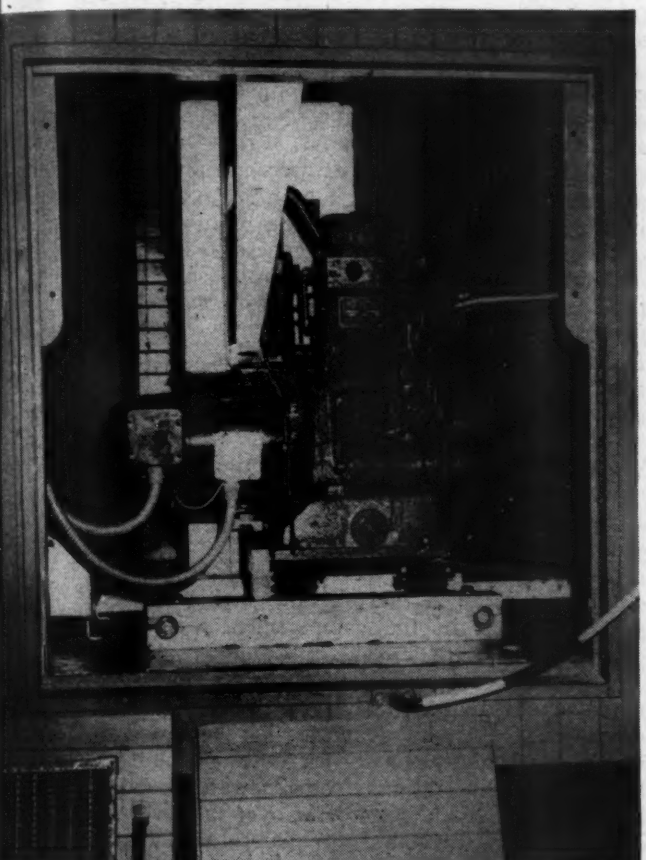
recorded. The pinion is then heated in an oven to 300 deg. F for a 4¼-in. by 9-in. pinion, and is allowed to remain in the oven for four or five hours to insure uniform heating. The hot pinion is then applied and the gauge is used immediately to assure 45 to 65 thousands of an inch advance or draw. Except in the case of hot bearings, no pinion so applied has come off.

The device is used in the shops of the Independent Subway of the New York Subway System on traction motors rated 195 hp. It was developed by F. W. Koebrich, motor-shop foreman.



Drawing showing the manner in which the indicator is used on a pinion and armature shaft

Power for Train Communication



The Diesel-engine generator power plant is seen through the side hatch opening

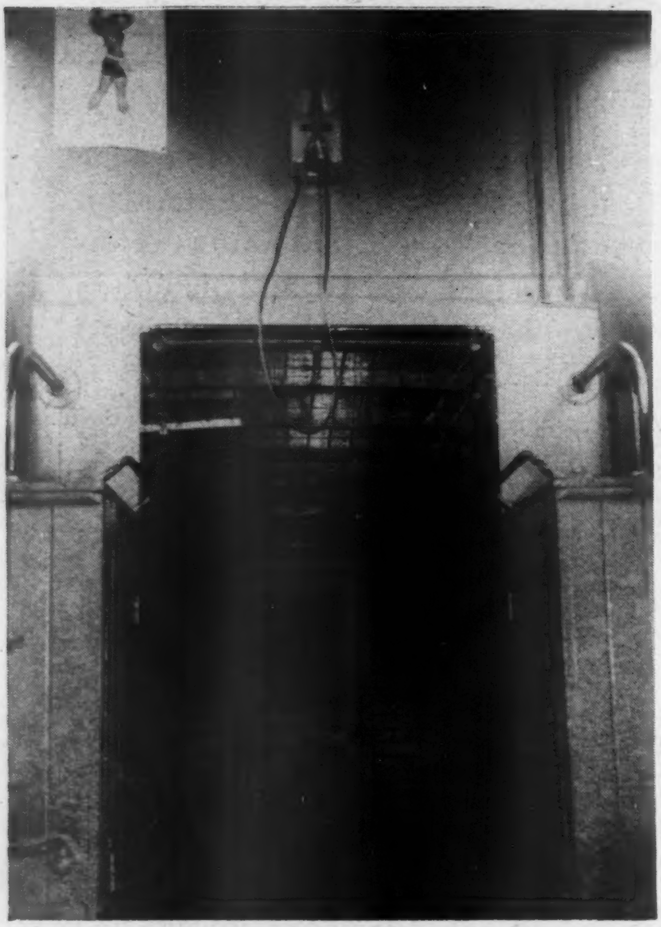
Duluth, Missabe & Iron Range uses Diesel-engine generators on cabooses — 1,000-watt turbo-generators and two dynamotors supply locomotive requirements

As a means of minimizing delays and of facilitating train operations, the Duluth, Missabe & Iron Range has installed inductive radio trains communication for use on all freight trains on a complete operating division including 440 miles of track, 10 locomotives, 17 cabooses and 7 wayside offices.

The principal traffic handled by the D. M. & I. R. is iron ore which is hauled from the mines in northern Minnesota to the ports at Duluth and Two Harbors on Lake Superior. From these ports the ore is shipped in lake boats to various points in the vicinity of steel mills at ports on the lower Great Lakes. The rail haul from the mines to the ore docks varies from about 60 miles to 95 miles. The Mesabi division, which has been equipped with the radio communication, extends west and north from Duluth to the mines on the Mesabi range at Coleraine, Taconite, Hibbing, Mitchell, Shenango, Buhl, Mt. Iron, Virginia and other towns.

As a general rule, the ore is hauled in solid trains, each consisting of 170 cars. The cars are each 24 ft. long, coupling to coupling. The older cars each have a capacity of 50 tons of ore, and the newer ones, 70 tons. The locomotives used on these ore trains are the mallet type, rated at 140,000-lb. tractive force. Train speeds are limited to 30 m.p.h., plus 5 miles tolerance for northbound trains, and 25 m.p.h., plus 5 miles tolerance, southbound. In order to minimize damage to equipment and to reduce the number of break-in-twos, special efforts are made to co-ordinate operations so that the southbound trains, which are loaded, need not be stopped from the time they leave the yards at the mines until they arrive in the Proctor yard near Duluth.

Left: One of the cabooses showing the removable panel over the engine compartment—Right: Step lights are mounted under the caboose and step brackets are cut out so that light will fall on the lower step



The caboose handset is shown on the cupola wall and one of the inside lighting units may be seen on the ceiling

The engine and train crews make their headquarters at Proctor, and ordinarily a run is made by taking a train of empty cars to a mine yard at some town on the range, and then returning to Proctor with a train of loaded cars. On the average, about 10 to 12 such trains are operated daily. A local freight train is operated each way daily except Sunday, and a local passenger train supplemented by branch line passenger service is operated each way daily.

The train communication equipment is the Aireon inductice radio type, operating at 170 kilocycles, frequency modulated.

The power supply on each caboose consists of a 3,000-watt, 60-cycle single-phase, 110-volt a.c. generator directly connected to a 4-hp., one-cylinder Diesel engine made by the Witte Engine Works, Kansas City, Mo. This unit is in operation continuously while the caboose is in service and supplies power for not only the train communication but also for electric lamps in and on the caboose. The total demand is less than the 3,000-watt capacity, but a Diesel-driven unit of smaller capacity was not available when the installation was made.

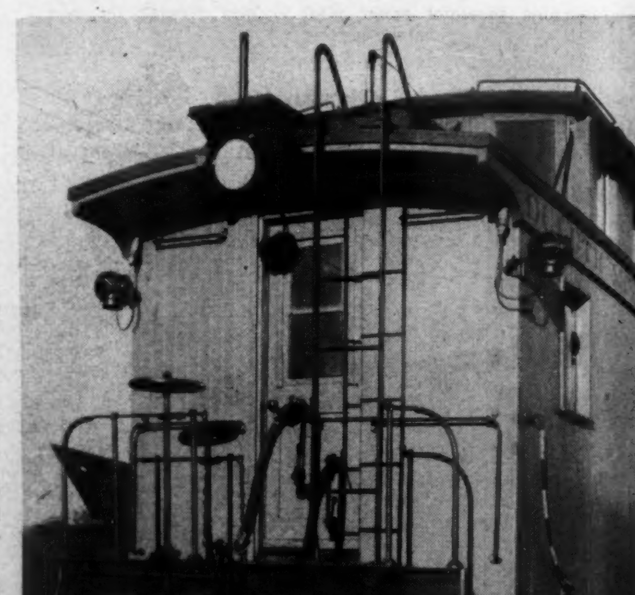
The engine-generator unit is mounted on rubber, and is housed in a special compartment which was constructed in one corner of the car. To minimize noise, the walls of this compartment were constructed with a ¾-in. board, a 1½-in. layer of hair felt insulation, a ¾-in. board and an inside lining of tinned sheet metal. The result is highly satisfactory, to the extent that when a train is traveling at normal speed, a man in a cupola, or the other end of the car, can hardly tell that the Diesel engine is running.

The engine-generator compartment is ventilated by the fan on the engine. Air is drawn in through a screened opening 18 in. square in the outside wall, and exhausts through a similar opening in the roof which is fitted with an overlapping weatherproof cover. The engine exhausts through a 1¼-in. pipe through the roof. Mufflers are used on some of the engines but not on others, and experience indicates that mufflers are not necessary.

From the inside of the caboose, two sliding doors give access to the engine-generator compartment. These doors are closed and locked by padlocks, the keys for which are held by maintenance forces. From the outside of the caboose, access to the compartment is gained by removing a special panel 49 in. high and 27 in. wide, which is normally held in place by bolts. This panel is taken out when removing an engine-generator for repairs.

When a train crew boards the caboose in a yard, hand pressure applied to a starter button starts the engine-generator, and it operates until the crew returns to Proctor yard and is ready to leave the caboose when the pressure on another button causes the Diesel engine to stop. In normal service the engine consumes about 4 gal. of distillate fuel oil when operated continuously for 24 hr., but in the ordinary procedure the machines are shut down when the cabooses are not in service between runs. Experience indicates that these engine-generators should render 10,000 hr. of operation before needing extensive repairs or overhauling, and this will be more than a year on this project. A fuel oil tank with a capacity of 20 gal. is located in the compartment with the engine-generator.

The train communication system requires 250 watts while standing by or receiving, and 400 watts while sending. The engine-generator has a capacity of 3,000 watts, which allows plenty for other purposes. Electric lamps of various ratings from 25 watts to 60 watts are located at the conductor's desk, over the air gauge in the cupola, and on the ceiling for general illumination of the interior of the caboose.

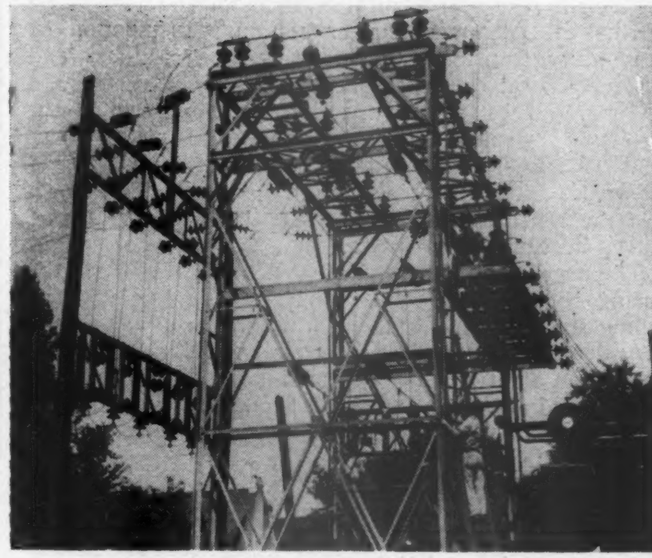


A back-up light is available for backing or for track inspection—The markers are electric

On the roof, at each end of the car, there is an enclosed reflector unit known as a "back-up" lamp, which is used to illuminate the track when backing up or to inspect the track from the rear of the train when running at night. Alongside each of the four steps on the caboose, there is a special lamp unit with a lens arranged to illuminate the steps as a means of improving safety when alighting from or boarding the caboose at night. These various lamp circuits can be turned on or off by switches in a cabinet on the wall in the gangway of the car.

Marker lights are equipped with 50-watt lamps. Cords extend to plug-in outlets near each lamp bracket. This circuit has power at all times when the engine-generator is in operation. With all the electric lamps lighted on a caboose, the consumption is 950 watts. The 100-watt back-up lamps are turned on but rarely and, under normal operations, only one would ever be used at a time. Thus the ordinary maximum demand for lighting would not exceed 200 watts and the train communication, 400 watts, totaling about 600 watts, which is well under the 3,000 watts capacity of the generator.

The locomotives in use were previously equipped with steam-turbine-driven d.c. generators, rated at 1,000 watts, 32 volts. From such a machine, on each locomotive, power is taken to drive two dynamotors. One dynamotor, which is in operation continuously, generates 300 volts, d.c., which feeds the radio receiving equipment. When the engineer presses his push-to-talk switch on his handset, a second dynamotor, in series with the other one, is started to increase the overall voltage to 600 volts, to feed the transmitting equipment. This machine starts so quickly that no first syllables are lost.



High-tension bus structure and transformers at the St. Albans, N. Y., substation

Long Island Adding Four Rectifier Substations

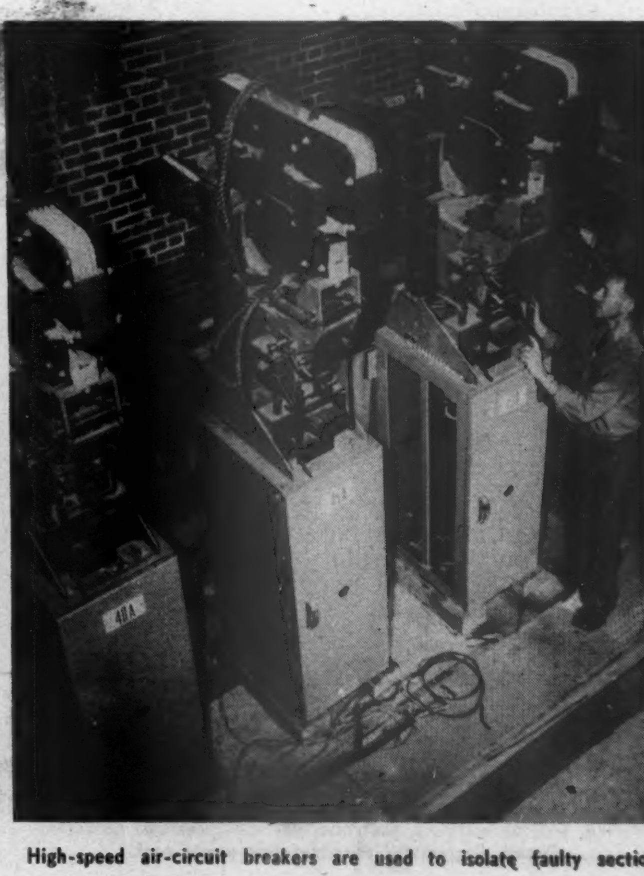
The Long Island's first postwar electric substation at St. Albans, L. I., N. Y., built at a total cost of $290,000, was placed in operation on September 9, 1947. This is

Single-anode, multiple-tank, mercury-arc rectifier in the new substation at St. Albans, N. Y.

the first of four similar substations to be located in the Jamaica, L. I., area as part of the broad improvement program promised in connection with the recent authorization to increase fares. Ground was broken July 14 for the second of these new substations at Cedar Manor, L. I., which is expected to be ready for service about November 1.

The railroad's traffic reaches its greatest density in the Jamaica area, and this new St. Albans unit is to help relieve the overload on the electrical distribution system which has occurred during peak hours between the older Laurelton and Hillside substations on the Atlantic Branch. The additional electrical capacity which this and other new substations are designed to provide will better enable the railroad to meet peak demands for current during rush hours, and will result in increased speed of operation and improved train lighting.

Construction started last May 6 on the St. Albans substation building, which is located at the east end of



High-speed air-circuit breakers are used to isolate faulty sections.

the freight yard near Central Avenue, about ¼ mile west of the St. Albans passenger station. Installation of heavy-duty transformers, mercury-vapor rectifiers and other electrical equipment began on July 28. Most of this material was part of the electrical equipment of the government-owned aluminum plant at Maspeth, L. I., which the Long Island Railroad purchased for $2,500,000 from the War Assets Administration, and which cost the railroad an additional $1,000,000 to dismantle, move, store and rehabilitate.

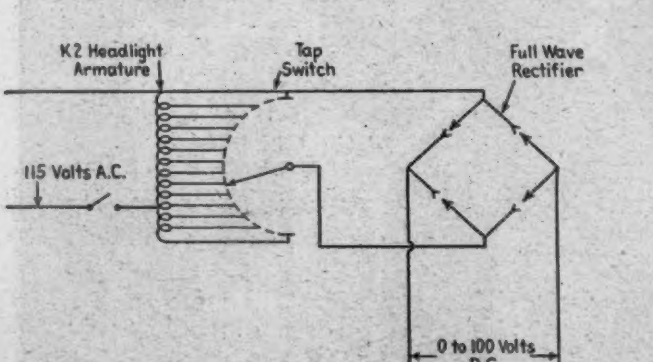
The urgent need for these new substations was created during recent years by a number of improvements to rolling stock and fixed facilities, which placed extraordinary demands on the basic electrical supply system at a time when additional heavy transformers, rectifiers, and switchboard equipment were not available because of the war. The increased load has been caused by increasing traffic, the use of electric switch heaters to prevent the jamming of interlocking plants by ice and snow and various improvements to rolling stock, including electro-pneumatic brakes, new motor-generator sets, automatic door controls, better lighting, etc. The addition of four, will make a total of 31 substations.

The new substation at St. Albans is an attractive building of modern functional design, constructed of brick and reinforced concrete, one story high, and measuring 38 x 58 ft., and is screened from neighboring residential structures by a row of linden trees.

Power Pack For Testing Relays

A LIGHTWEIGHT, portable power pack which supplies variable d. c. voltage for testing relays on Diesel-electric locomotives has been developed in the Erie's Diesel shop at Marion, Ohio. It was made primarily for testing the pick-up and drop-away voltages of d. c. relays and will deliver sufficient current for this purpose at any voltage from to 0 to 100 volts. To test a relay it is only necessary to connect the d. c. output leads of the power pack to the relay, raise the voltage until the relay picks up and then lower it until it drops out. A voltmeter on the panel of the power pack unit indicates the voltages at which these functions occur. The pack also supplies enough current for operation without load of fuel pump motors, cab-heater motors, and defroster motors and is used to check their operation.

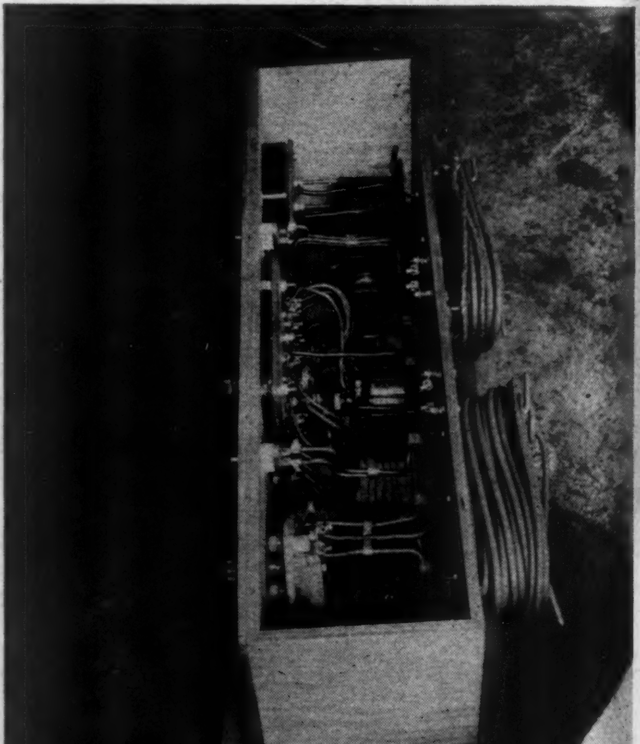
The power pack is made from two Westinghouse Rectox units put together to make a full-wave rectifier, a rheo-



Circuit diagram for the relay test power pack

Front view of the power pack showing the voltmeter, and the tap-switch and rheostat controls

stat, a tap switch and a discarded Pyle-National, type K2 headlight armature, all connected as shown in the diagram. The armature is opened at one point and is connected in the circuit as an auto-transformer which receives



Top view of the unit showing the rectifiers at each end, the tap switch and K2 armature at the center, meter at the far end, and rheostat in front

a. c. power from any light socket and delivers a varied a. c. voltage from about 10 to about 130. This output is passed on to the rectifier and the d. c. output of the rectifier is used directly for testing. A rheostat in the d. c. output circuit can be used either as a vernier, or a potentiometer to control the voltage. It has a sufficient range to cover any of the voltage steps affected by the tap switch. The complete unit is housed in a wooden cabinet 36-in. long. At the front of the cabinet is a Bakelite panel on which are mounted the 0-100 voltmeter and two

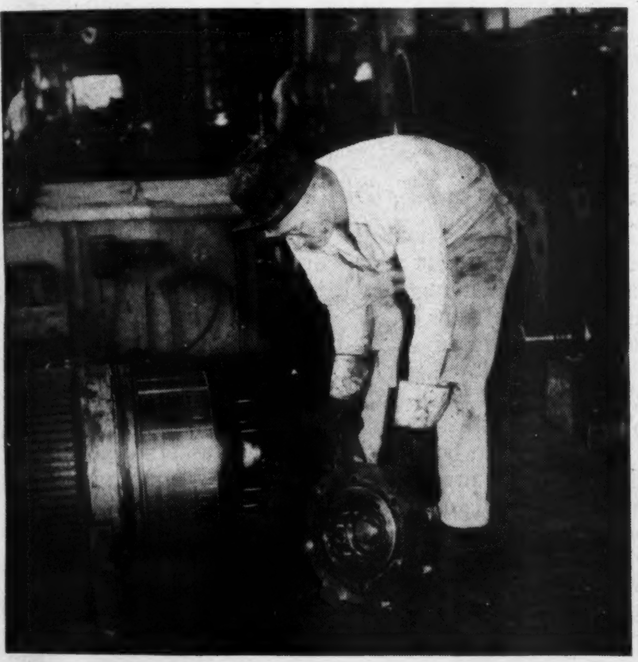
knobs for controlling the tap switch and the rheostat respectively. On the back of the cabinet are hooks on which the a. c. and d. c. leads are wound when the unit is not in service.

The power pack was designed and built by F. P. Lawler, electrical foreman, Erie Railroad.

Rock Island Disposes of Bearing Trouble

The Chicago, Rock Island & Pacific has practically eliminated Diesel-electric locomotive traction-motor bearing failures by practices now in vogue at its Silvis, Ill., shops. At one time a high percentage of all motor failures were bearing failures and the total number has been substantially reduced.

Present practice involves the use of SKF roller bearings with type D-7 traction motors. The lubricant used is M-7 grease made by the Master Lubricant Company, Philadelphia, Pa.



Commutator-end bearing after removal preparatory to shipment to the manufacturer for reconditioning

Traction motors are normally overhauled every 200,000 miles. At this time, motor bearings are removed and returned to the manufacturer, where they are inspected, repaired as may be necessary, and returned to the railroad. This involves a charge to the railroad amounting to a percentage of the cost of a new bearing. If retainers are required, they are supplied, also at a slightly increased cost. Should either the inner or outer race require renewal, it is supplied at an added cost and a complete new bearing is furnished if necessary.

The arrangement requires that the railroad keep a pool of bearings on hand. This is equal to about five per cent of the bearings in service.

Former practice required that the railroad clean, inspect, relubricate, wrap and store the bearings in a dust-proof container. It also involved the keeping of a record of the mileage on each motor since bearings were guaranteed and repaired on a mileage basis. This made it necessary for the manufacturer to accept the railroads data on mileage and also entailed arguments about abuse of bearings, etc. The former practice of reconditioning and storing bearings incurred a cost to the railroad which was about two thirds of their present billing for new rollers.

Pulling a pinion-end bearing

The new practice has been in effect for about two years and during this time only one bearing has failed. There are now between 400 and 500 traction motor bearings in service on the railroad. About 80 per cent of the bearings returned by the manufacturer require new rollers only.

* * *

Courtesy of Seaboard Airline Railroad

Telephone communication facilitates the operation of train movements on the Seaboard

Protection of Stored Transformer Oil

What is the best method of storing transformer oil to prevent or reduce its contamination with moisture?

Deterioration Is Caused by Moisture and Oxidation

The oil used in transformers serves two important purposes. It serves to insulate the various coils from each other and from the core, and it conducts the heat produced in the coils and core to the transformer cooling fins, tubes, corrugations, or other cooling surfaces for dissipation. It is evident, therefore, that transformer oil should be kept free from conducting materials; that it is sufficiently fluid to circulate freely when subjected to differences of temperature; and that it is not unstable except at very high temperatures.

The principal causes of deterioration of transformer oil are water and oxidation.

Contamination of water or moisture with transformer oil occurs when the latter is exposed to condensations from moist air as atmospheric temperature changes. The condensation takes place at the surface of the oil and on the inside of the transformer or storage tank. It should be noted that moisture to the extent of 0.06 per cent reduces the dielectric strength of the oil to about 50 per cent of the value when it is free from moisture. Increase of moisture beyond that percentage, however, does not cause the dielectric strength to decrease in the same proportion.

Any transformer oil will deteriorate by oxidation. The extent of oxidation is indicated by the formation of sludge which is dependent on the temperature of the air and the length of time the oil is exposed to it. Sludge, in itself, is harmless but its accumulation seriously hampers the cooling action of the oil by clinging to the coil windings, coil ducts, and other inner heat dissipating surfaces, and thus forming a heat-insulating layer in the transformer. The formation of sludge in the transformer or storage tank is also associated with the development of acidity which is usually harmful as it tends to hold up in suspension any moisture that may be present and thus reduce the dielectric strength of the oil. This effect may be minimized by keeping the oil dry.

The darkening of transformer oil with time—as it takes atmospheric oxygen in solution—should not be misinterpreted as an indication of gradual loss of its heat-carrying capacity except that darkening is usually associated with a slight increase of viscosity which retards normal circulation.

The location of a storage tank depends on various factors. In order to prevent the contamination of oil with moisture, it is necessary either to remove the moisture from the air before it comes in contact with it or to maintain the oil at a temperature somewhat higher than that of the air coming in contact with it. If the storage tank is buried completely underground, the oil temperature will evidently have a tendency to vary within a limited range from season to season while the temperature above ground will vary within wide limits. Even in this case, however, condensation may only be prevented by providing heaters of suitable capacity in the bottom of the tank to maintain an oil temperature somewhat higher than ambient temperature.

Another method is to equip the storage tank with a calcium chloride breather to dry the air entering the tank as oil is pumped out of it. The breather should have its inlet at the bottom and its outlet at the top leading to the top of the tank. If the breather is sealed when oil is not being pumped out of the tank, the calcium chloride will be effective for a longer period than if left open to the atmosphere continually. A breather of this type may be made locally by closing the two ends of a five-foot piece of iron pipe of about five-inch size and filling it with alternate layers of steel wool and flake calcium chloride. A drain with a valve and provision for sealing the air inlet are also desirable features of a good air drying breather.

R. G. Cazanjian

Can you answer the following question? Answers should be addressed: Electrical Editor, *Railway Mechanical Engineer*, 30 Church Street, New York 7.

Would the lead sheathing on a single-conductor lead-covered cable cause any heating due to induction if three single-conductor cables were used for supplying a three-phase motor?

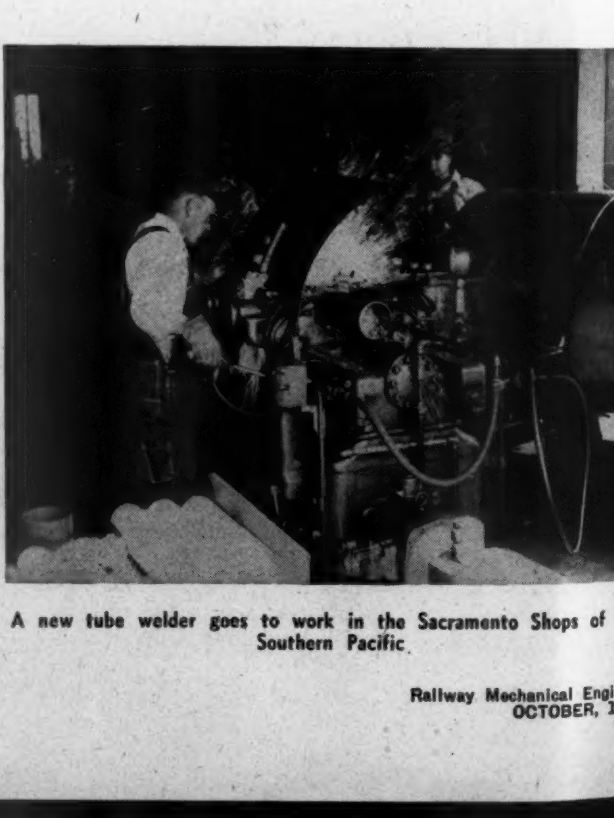
Specifications Are "Tight" and "Dry"

Transformer oil should be kept in tight, clean cans, or if the oil is received in a steel drum, there is no particular reason for not leaving the oil in the drum until it is used. Full cans or drums of oil that have not been opened may be stored in any place that such containers of other oils would be stored, but they should not be opened in a damp place nor when humidity of the air is high. It is always best to fill transformer on a dry day.

If the oil is to be transferred to containers other than original ones, precaution should be taken to avoid moisture. If cans or drums used are suspected of containing moisture or even moist air, they should be dried by heating. If a method of heating is not available, rinsing them out with carbon tetrachloride will eliminate surface moisture inside the containers.

W. L. Cotton

* * *



A new tube welder goes to work in the Sacramento Shops of the Southern Pacific

NEWS

Simmons - Boardman Subscription Sales Representative

G. R. Higham of Middletown, Ohio, has succeeded B. R. Currier as subscription sales representative for the Simmons-Boardman Publishing Corporation in the following states and provinces of Canada: North Dakota; South Dakota; Nebraska; Minnesota; Iowa; Wisconsin; Illinois; Michigan; Indiana; Kentucky; Ohio; West Virginia; Manitoba, Canada, and Ontario.

Equipment Depreciation Rates

Equipment depreciation rates for the Detroit & Mackinac and the Toledo, Peoria & Western have been prescribed by the Interstate Commerce Commission in a new series of sub-orders modifying previous sub-orders in the general proceeding, entitled Depreciation Rates for Equipment of Steam Railroad Companies.

The rates prescribed for the D.&M. are: Steam locomotives, 2.38 per cent; other locomotives, 3.89 per cent; freight-train cars, 5.25 per cent; passenger-train cars, 5.07 per cent; work equipment, 10.41 per cent; miscellaneous equipment, 9.43 per cent. The T. P. & W. rates are: Steam locomotives, 3.79 per cent; freight-train cars, 5.64 per cent; work equipment, 5.3 per cent; miscellaneous equipment, 10.02 per cent.

Welding Society Elects Magrath Executive Secretary

At a meeting on July 11, the board of directors of the American Welding Society unanimously selected Joseph Gordon Magrath to the new position of executive secretary of the society, the duties of which he assumed on September 2. As the chief staff officer of the society, Mr. Magrath will work with other members of the headquarters staff in directing the activities of this national engineering organization of about 7,500 members. M. M. Kelly, secretary; W. Spraragen, editor of the Welding Journal and director of the Welding Research Council, and S. A. Greenberg, technical secretary, will continue in their present duties.

Mr. Magrath was born in Philadelphia on July 28, 1899. He is a registered engineer of the state of Illinois, and in addition to being a member of the A.W.S., he is a member of the American Society for Metals, Society of American Military Engineers, and the Steam Specialties Club, New York. Just before joining the staff of the A.W.S., Mr. Magrath was sales manager of the McAlear Manufacturing division of Climax Industries, Inc.

From 1934 to 1944, Mr. Magrath was associated with the Air Reduction Sales

J. G. Magrath

Company. With this company he supervised market, process and product demand surveys and promotion sales activities through sales and service engineering staff of 26 district offices. Mr. Magrath was associated directly with welded product design as far back as 1917, first with the Budd Wheel Manufacturing Company on the fabrication of wheel structures for the first world war "quads" (original four-wheel drive ordnance vehicles); then in 1922 to 1923 on welded steel sash, doors and plate fabrication for the David Lupton Sons Company. During the recent war he was active, while with the Air Reduction Sales Company, in the exploration of welding, cutting, brazing, and other flame-treatment processing of welded fabrication in shipyards on the East, Gulf and West coasts, as well as inland war plants and steel mills. Mr. Magrath has been active in the work of the New York section of the American Welding Society and served for several years as chairman of publicity and programs.

Miscellaneous Publication

Aluminum Casting Alloys.—Aluminum Research Institute, 111 West Washington street, Chicago 2, has published a 78-page, 6 in. by 8¾-in. loose-leaf binder, entitled a "Manual of Aluminum Casting Alloys". The manual, based on an extended research program sponsored by A. R. I. at Case Institute of Technology, has

Orders and Inquiries for New Equipment Placed Since the Closing of the September Issue

Locomotive Orders

Road	No. of locos.	Type of loco.	Builder
Erie	5	1,000-hp. Diesel-elec. switch.	American Locomotive
	5	1,000-hp. Diesel-elec. switch.	Electro-Motive
	1	660-hp. Diesel-elec. switch.	Electro-Motive
Seaboard Air Line	12	2,000-hp. Diesel-elec. pass.	Electro-Motive
	6	1,500-hp. Diesel-elec. frt.	American Locomotive
	3	1,000-hp. Diesel-elec. switch.	American Locomotive

Freight-Car Orders

Road	No. of cars	Type of car	Builder
Chicago, Indianapolis & Louisville	50	70-ton mill type gondola	Greenville Steel Car
	300	50-ton fixed-end gondola	Pullman-Standard
Chicago Heights Terminal Transfer	25[1]	70-ton covered hopper	General American
	15[1]	70-ton gondola	Pressed Steel
Delaware, Lackawanna & Western	500[2]	50-ton box	American Car & Fdry.
Illinois Terminal	100[1]	50-ton box	American Car & Fdry.
Lehigh Valley	500	55-ton hopper	Bethlehem Steel
Seaboard Air Line	500[3]	50-ton box	Pressed Steel
	300[3]	70-ton hopper	Bethlehem Steel
Shell Chemical Corp.	36	8,000-gal. aluminum tank	American Car & Fdry.

Freight-Car Inquiries

Road	No. of cars	Type of car	Builder
Chesapeake & Ohio	1,000	50-ton gondola	
	500	70-ton covered hopper	
	150	30-ton caboose	
Chicago, Burlington & Quincy	200	70-ton tank	
Columbia Steel Co.	45	70-ton gondola	
Erie	1,000	50-ton hopper	
	700	50-ton box	
	100	70-ton covered hopper	
Pennsylvania	500-2,000	50-ton box, Type X41B	
	500-2,000	50-ton box, Type X41C	
Seaboard Air Line	400	Gondola	
Wheeling & Lake Erie	1,000	70-ton hopper	
	12	Covered hopper	

[1] Delivery scheduled for second quarter of 1948.
[2] Delivery scheduled to begin during first quarter of 1948.
[3] Deliveries scheduled for early in 1948.
[4] To be of all-welded construction.

Note: *St. Louis-San Francisco.*—The board of directors of the St. L.-S. F. has authorized the purchase of an additional $10,393,686 in new equipment. The road will buy 19 Diesel-electric road freight and switching locomotives, 1,300 freight cars and other operating facilities, bringing the Frisco's total expenditures in its present improvement program to more than $17,000,000.

been prepared for design engineers, foundrymen, and users of castings. It contains tabular data on physical and mechanical properties of various sand and permanent mold Aluminum alloys most commonly used; general metallurgy of Aluminum alloys; properties of specific alloys; foundry practice; and heat treatment, and is illustrated with photographs, charts, line drawings, and phtotomicrographs. The book will be mailed, free, to applicants on Company letter-heads.

Supply Trade Notes

K. W. BATTERY COMPANY.—*B. E. Wurtmann,* vice-president of the Manheim Manufacturing & Belting Co., has been appointed manufacturer's agent for eastern railroads by the K. W. Battery Company, Chicago, to handle railway sales of car-lighting and air-conditioning batteries. Mr. Wurtmann will continue to handle Manheim Manufacturing & Belting products as heretofore.

◆

TWIN DISC CLUTCH COMPANY.—*Roger G. DeLong* and *W. B. Gibson* have been appointed, respectively, manager and sales manager of the hydraulics division of the Twin Disc Clutch Company, and *Wade A. Eskrgidge* has been appointed assistant district manager in the mid-continent territory to take charge of operations in the Tulsa, Okla., office. *H. A. Davis,* formerly manager at Tulsa, has been transferred to Dallas, Tex.

◆

E. I. DU PONT DE NEMOURS & CO.—*Granville M. Fisher* has been appointed railway finishes salesman in the New England and New York area for the finishes division of E. I. du Pont de Nemours & Co., with headquarters in New York, to succeed the late *Roy A. Phelps.*

◆

INTERCHEMICAL CORPORATION. — *Charles F. Kahnhauser* has been appointed sales manager of metal decorating products for the finishes division of the Interchemical Corporation, with headquarters in the Philadelphia, Pa., district office. Mr. Kahnhauser was formerly a varnish salesman for the Ault & Wiborg Co., Cincinnati, Ohio, now a part of Interchemical. He has been in the Philadelphia office of the parent company since 1942.

◆

SIMMONS-BOARDMAN PUBLISHING CORPORATION.—*C. W. Merriken, Jr.,* sales representative of the Simmons-Boardman Publishing Corporation at Chicago, has been appointed sales manager, railway publications, Eastern district, with headquarters at New York. Mr. Merriken was born at Baltimore, Md., on August 12, 1907, and received his higher education at the University of Illinois. He entered railway service in 1930 as a chainman on the Chicago & North Western, and one year later he went with the Chicago, Milwaukee, St. Paul & Pacific as a rodman at Chicago. From 1932 to 1935 he was associated with the sales department of the Pure Asphalt Company at Chicago, and in the latter year he returned to the North Western as a rodman on the Galena division. In March, 1938, Mr. Merriken went with the Belt Railway of Chicago as a rodman, and in October of the same year he resigned to become an associate editor of the Railway Engineering and Maintenance Cyclopedia. On March 4, 1940, he was appointed sales representative of Simmons-Boardman at Chicago.

C. W. Merriken, Jr.

◆

AMERICAN STEEL & WIRE CO.—*C. F. Wiley* has been promoted to assistant manager of the district sales office of the *American Steel & Wire Co.,* a subsidiary of the United States Steel Corporation, with headquarters at Chicago.

◆

RAILWAY RADIO-TELEPHONE, INC., has appointed the *O. K. Company,* of which *Tom R. King* is president and *Karl V. Graff* is vice president, as its sales representatives in Chicago, and *J. M. Welles* as its sales representative in Los Angeles, Calif. Offices of the O. K. Company are located at 513 Railway Exchange Building, Chicago, and of Mr. Welles at 112 West Ninth street, Los Angeles.

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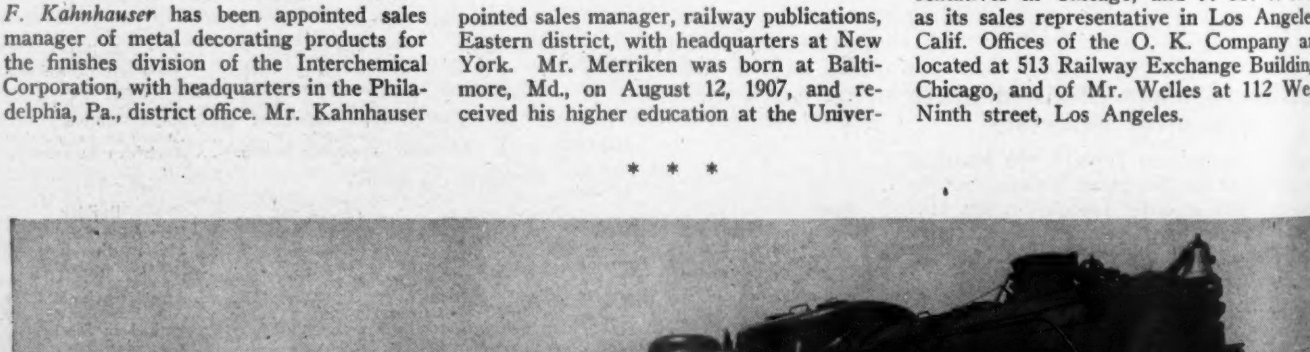


No. 5658, one of the 13 mountain-type locomotives recently bought by the Baltimore & Ohio from the Boston & Maine. With 67,000 lb. tractive force, 73-in. drivers and a tender capacity of 21 tons of coal and 20,000 gal. of water, these locomotives are now in high-speed freight service on the B. & O. between Chicago and Newcastle, Pa.

AIRETOOL MANUFACTURING COMPANY.—The *Huron Manufacturing Company,* 3240 East Woodbridge street, Detroit 7, Mich., has been appointed national railway sales representative for the Airetool Manufacturing Company, Springfield, Ohio.

Thor Thornson has been appointed general sales manager in charge of sales, advertising and promotion for the Airetool Manufacturing Company. Mr. Thornson will head a staff of representatives serving

Thor Thornson

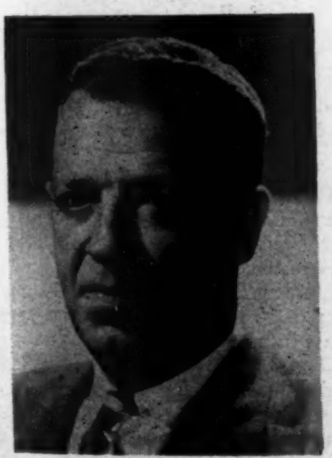
the refinery, marine, power and locomotive repair industries. As a refinery engineer, he has spent 15 years in oil refineries in Michigan and Canada.

◆

FAIRBANKS, MORSE & CO.—*James G. Graham* has been appointed sales manager of the railroad division of Fairbanks, Morse & Co. Mr. Graham will continue to maintain his headquarters at the main office in Chicago, where he has served as district manager of the railroad division since joining the company a year and a half ago.

◆

AMERICAN CAR & FOUNDRY CO.—*Henry V. Bootes,* formerly sales agent for the American Car & Foundry Co., has been appointed district sales manager, New York sales district, with headquarters as before



Henry V. Bootes

in New York. Before joining American Car & Foundry, Mr. Bootes was district manager of the Ohio Injector Company. During world war II he served as a major in the United States Marine Corps.

METAL & THERMIT CORP.—*O. L. Howland* has been appointed sales manager of the welding division of the Metal & Thermit Corp., with headquarters in Chicago.

O. L. Howland

William C. Cuntz has been appointed assistant sales manager of the welding division, with headquarters at Pittsburgh, Pa.

O. L. Howland is a graduate of the University of Wisconsin. After graduation he began his business career with a surveying party of the Phelps-Dodge Corporation in Mexico. During World War I he served in the merchant marine, immediately after which he became associated with the Central Steel & Wire Co. of Chicago, as a welding specialist. In 1924 he became district manager of the Lincoln Electric Company in Indianapolis, Ind., and two years later returned to Central Steel & Wire From 1927 to 1931 he was general manager of the Koro Corporation. In 1932, he was appointed eastern manager for the Hollup Corporation and, in 1936, sales manager at the Chicago office. Mr. Howland headed the War Production Board's welding division in Washington. during the war.

◆

WESTINGHOUSE AIR BRAKE COMPANY.—*T. H. Bickerstaff* has been appointed representative of the Westinghouse Air Brake Company, with headquarters in Chicago. The company also has announced that *D. G. Blaine,* engineer, and *W. K. Fry,* mechanical experts, have been transferred

T. H. Bickerstaff

from the home office at Wilmerding, Pa., to Chicago, and *W. V. Steele* and *H. W. Wiss* have been assigned to the New York office, where they will work in engineering capacities.

T. H. Bickerstaff, formerly a locomotive engineer on the Atchison, Topeka & Santa Fe, joined Westinghouse Air Brake in April, 1946, and in July of that year went to the Chicago office as mechanical expert.

◆

PYLE NATIONAL COMPANY.—*Carl Geis* and *T. E. McDowell* have been elected vice-presidents of the Pyle-National Company, Chicago, the former in charge of sales and the latter in charge of engineering.

Carl Geis, who has been eastern sales manager with headquarters in New York

Carl Geis

City since 1937, started with the Pyle-National Co., as a clerk in 1914. After a period of service in the U. S. Army Air Corps, Mr. Geis worked out of the Chicago office as a service engineer from 1919 to 1923. He was then transferred east and in 1928 established an office in Boston, Mass., as district sales manager for New

T. E. McDowell

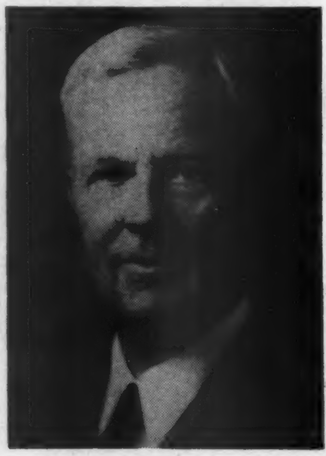
England. In June 1935, he returned to New York as district sales manager.

T. E. McDowell has been chief engineer in charge of product design since 1936. After graduating from the Illinois Institute of Technology he served a brief period with the Illinois Bell Telephone Company, then joined the Pyle-National Co., in 1935, as

an electrical engineer. Mr. McDowell is a member of the Illuminating Engineering Society.

◆

Lima-Hamilton Corporation. — Combination of the activities of the *Lima Locomotive Works, Inc.*, Lima, Ohio, and the *General Machinery Corporation*, Hamilton, Ohio, into one company known as the Lima-Hamilton Corporation, was approved by stockholders of each company at meetings held on October 1. The action, which followed the plan of reorganization authorized by the respective boards of directors in August, brings together two of the country's oldest manufacturing concerns in the heavy equipment field for the manufacture of Lima-Hamilton Diesel locomotives and continued production of steam locomotives, as well as a comprehensive line of heavy railroad and industrial equipment. The top executive organization of Lima-Hamilton includes *Samuel G. Allen*



S. G. Allen

as chairman of the board; *George A. Rentschler*, chairman of the executive committee, and *John E. Dixon*, president. Mr. Allen and Mr. Rentschler were board chairmen, respectively, of the Lima Locomotive Works and the General Machinery Corporation, while Mr. Dixon was president of Lima.

Established in 1869, the Lima Locomotive Works has long been a producer of steam locomotives and, since 1928 when it installed a shovel and crane division, has become an extensive manufacturer of power shovels, cranes, draglines, and related equipment. During the war it produced combat tanks for the U. S. Army.

With origins dating back to 1845, the General Machinery Corporation is well known as builder of Hamilton Diesel engines. General Machinery's development work for the past four years with a free-piston gas generator turbine promises future application in locomotives, ships, and stationary power plants.

Facilities of the two companies are located within 100 miles of each other and the unification is expected not only to complement manufacturing lines, but also to effect economies in operation.

In addition to the manufacture of Diesel and steam locomotives, considerable diversification of Lima-Hamilton's products is afforded through General Machinery's Niles line of heavy and medium machine tools for railroad and industrial use, its Hamilton line of presses for the automotive industry, and its experience in the manufacture of special machinery, such as plate-glass polishing, sugar grinding and crushing machinery, and its recently developed can-making machinery. During the war General also produced more than 800 large steam reciprocating engines for use in Liberty ships.

Formed in 1928, the General Machinery Corporation that year acquired the Niles Tool Works Company, producers of large railroad and machine tools and special-purpose machinery, to merge it with the Hooven, Owens, Rentschler Company, both of which date back to 1845. The latter firm, in addition to the production of stationary steam and gas engines, began Diesel-engine construction in 1924 when it built the first Hamilton Diesel. Five years after this merger, General Machinery, in 1931, acquired the Hamilton Press & Machinery Co., manufacturers of large presses for the automotive field, and the Putnam Machinery Company. Prior to the war the General Machinery Ordnance Corporation, a subsidiary, was organized in 1940 at South Charleston, W. Va., for the production of naval ordnance, and, in 1942, substantial stock interest was acquired by the General Machinery Corporation in the Southeastern Shipbuilding Corporation at Savannah, Ga., where more than 100 Liberty ships and a number of AV1 cargo vessels were built during the war. General Machinery also obtained major stock interest in another affiliate, the United Welding Company, Middletown, Ohio.

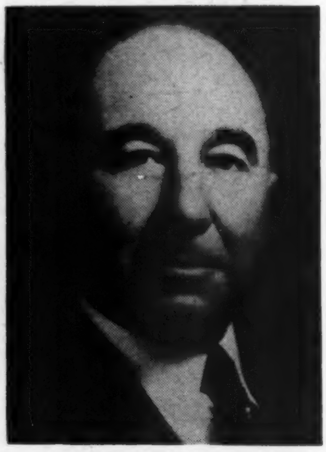
Samuel G. Allen, chairman of the board of the new Lima-Hamilton Corporation, has been prominent in the railroad supply field since 1900. He is also board chairman of the American Arch Company, the Franklin Railway Supply Company, the Superheater Company, and the G. M. Basford Company. He is chairman of the executive committee and a director of the Combustion Engineering Company, and a director of

G. A. Rentschler

the Lummus Company and the Locomotive Booster Company.

George A. Rentschler, chairman of the Lima-Hamilton Corporation executive committee, began his career in the machine industry with the Hooven, Owen, Rentschler Company. In 1929 he became president of the General Machinery Corporation and, later, chairman. He is a director of the Philip Carey Manufacturing Company, the Motor Wheel Corporation, the Barber Asphalt Corporation, the Charleston Shipbuilding & Drydock Co., and the Cincinnati Gas & Elec. Co.

John E. Dixon, president of the Lima-Hamilton Corporation, entered the locomotive field in 1900 with the Brooks Locomotive Works which was absorbed a year later by the American Locomotive Com-



J. E. Dixon

pany. He was moved from the Brooks plant to the sales department in the New York office of the American Locomotive Company in 1904, becoming assistant sales manager. In 1916 he was elected vice-president of the Lima Locomotive Works, of which he beame president in 1939. Mr. Dixon is also a director of the Franklin Railway Supply Company, the Combustion Engineering Company, and the Superheater Company.

◆

Baker-Raulang Company.—*J. G. Green*, for the past five years assistant general manager of the Philco storage battery division of the Philco Corporation, has been appointed mid-western representative for the Baker industrial truck division of the Baker-Raulang Company. Mr. Green's headquarters will be at 407 South Dearborn street, Chicago.

◆

American Brake Shoe Company.—*Selby F. Greer*, formerly assistant general sales manager, has been appointed general sales manager for the Kellogg division of the American Brake Shoe Company to succeed *H. O. Holland*, a vice-president, who will assume new duties.

Charles S. Sliter, formerly sales promotion manager for the American Brake Shoe Company, has been appointed assistant general sales manager of the Kellogg division, with headquarters in Rochester, N. Y.

◆

Reynolds Metals Company.—*Harry E. Weiler* has been appointed manager of the Louisville, Ky., district sales office of the Reynolds Metals Company, serving all of

THE TOUGH GUY

IS NO

NEWCOMER

Today's Chilled Car Wheel has come a long, long way since the days of Stephenson's "Rocket" and the Stourbridge "Lion." And we at AMCCW are proud to have a part in promoting a steady advance in wheel quality as evidenced by today's "Tough Guy."

We do this by tightening up our code of manufacturing practices. We do it by a never ending search for new ways to make sure that all AMCCW members can say "every wheel shipped is as good as the best."

And, to put our aims into effect, we maintain a staff of resident inspectors, general inspectors, supervisors and technically-trained metallurgical personnel.

AMCCW

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

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American Car & Foundry Co. • Canadian Car & Foundry Co. • Griffin Wheel Co.
Marshall Car Wheel & Foundry Co. • Maryland Car Wheel Co. • New York Car Wheel Co.
Pullman-Standard Car Mfg. Co. • Southern Wheel (American Brake Shoe Co.)

5027

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2 REFRACTORY COATING – Bulletin provides general information about Brickseal Refractory Coating, a combination of high-fusion clays and metal oxides mixed in oil which forms a highly glazed protective coating for refractory brick of all kinds. Shows uses, grades and results. Brickseal Refractory Co.

3 METAL PROTECTION – Fact-filled 4-page brochure explaining use of Serviron Metal Protector, a grease-like semi-plastic material which can be brushed or sprayed on metals for protection from weather, brines and alkalies. Especially suited to protecting and lubricating railroad switches, signals, and track parts. Serviron Metal Protector Company.

4 SOOT REMOVER – Attractively prepared bulletin contains considerable data on the use of XZIT Firescale & Soot Remover in industrial and marine fields. Shows stack temperature comparisons before and after using product. Offers five ways of reducing boiler operating costs. XZIT Sales Co.

5 REFRACTORY COATING – Bulletin gives information about the use of Vango Refractory Coating in crucibles, pouring ladles, forging and heat-treating furnaces. Discusses application, uses and effectiveness for all types of firebrick, cast or plastic refractories. Vango Refractory Company.

PASTE TO POSTCARD AND MAIL

Circle number of item describing the catalog wanted. 1 2 3 4 5

COMPANY NAME__________

ADDRESS__________

____

YOUR NAME__________

TITLE__________

RAILWAY MECHANICAL ENGINEER
Box No. 545, 30 CHURCH STREET
NEW YORK 7, NEW YORK

Kentucky except Kenton and Campbell counties. The office also covers southern Indiana. Mr. Weiler is a graduate of the Georgia School of Technology with a B.S. degree in engineering. He did graduate

Harry E. Weiler

work at Northwestern University and the Illinois Institute of Technology and later worked successively for the Tennessee Eastman Corporation, the Enterprise Wheel and Car Corp., and the Revere Copper & Brass Co. Mr. Weiler joined Reynolds Metals as assistant to the general product manager at Louisville and later became product manager of the extrusion and tubing division.

PHILADELPHIA STEEL & WIRE CORP.—The Philadelphia Steel & Wire Corp. has appointed *L. P. Brassy,* 55 New Montgomery street, San Francisco, Calif., as its agent covering the western territory.

◆

UNITED STATES STEEL SUPPLY COMPANY.—*Edgar J. Reichenbach* has been appointed manager, specialties and machinery division of the general sales department of the United States Steel Supply Company (a subsidiary of the United States Steel Corporation), with headquarters at Chicago. Since 1937 he has served as salesman in the Chicago district sales department.

◆

WEATHERHEAD COMPANY. — *William L. Hauck* has been appointed eastern district sales manager of the Weatherhead Company, with headquarters in New York. Mr. Hauck was formerly district sales manager for the Scaife Company.

◆

AMERICAN LOCOMOTIVE COMPANY.—The headquarters offices of the Alco Products division of the American Locomotive Company have been transferred from New York to Dunkirk, N. Y. *Hugh M. Corrough,* director of the division, will direct all sales, engineering and manufacturing from the Alco plant in Dunkirk.

◆

BERNARD WELDING EQUIPMENT COMPANY.—*Arthur A. Bernard,* who has worked on the development and practical application of welding processes, equipment and

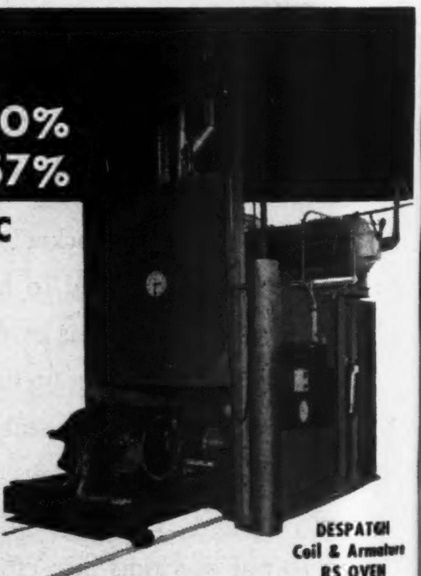
Cuts

BAKING TIME 40%
WARM-UP TIME 57%

for DIESEL - ELECTRIC MAINTENANCE

Baking time for large diesel generators and diesel-electric motors was reduced 40 to 50% at Great Northern shops, St. Paul, when this modern DESPATCH gas fired, convection heat oven was installed. Warm-up time was cut 57% over previous steam-heated oven.

Two giant 3-ton 36"x38" armatures or motors bake *thoroughly* in 12 instead of 20 or more hours. Six smaller 1-ton 18"x36" armatures bake in 8 hours instead of 16. These heavy components are dried after cleaning, or baked after vacuum impregnation, dipping or spraying with varnish. Loads are conveniently handled with traveling crane and rail-mounted dolly.



DESPATCH Coil & Armature RS OVEN

Other Advantages

- Increases baking capacity.
- Operates economically.
- Requires less attention.
- Saves time and manpower.
- Rugged, safe and dependable.
- Bakes uniformly up to 500 F.
- Controls temperature automatically.

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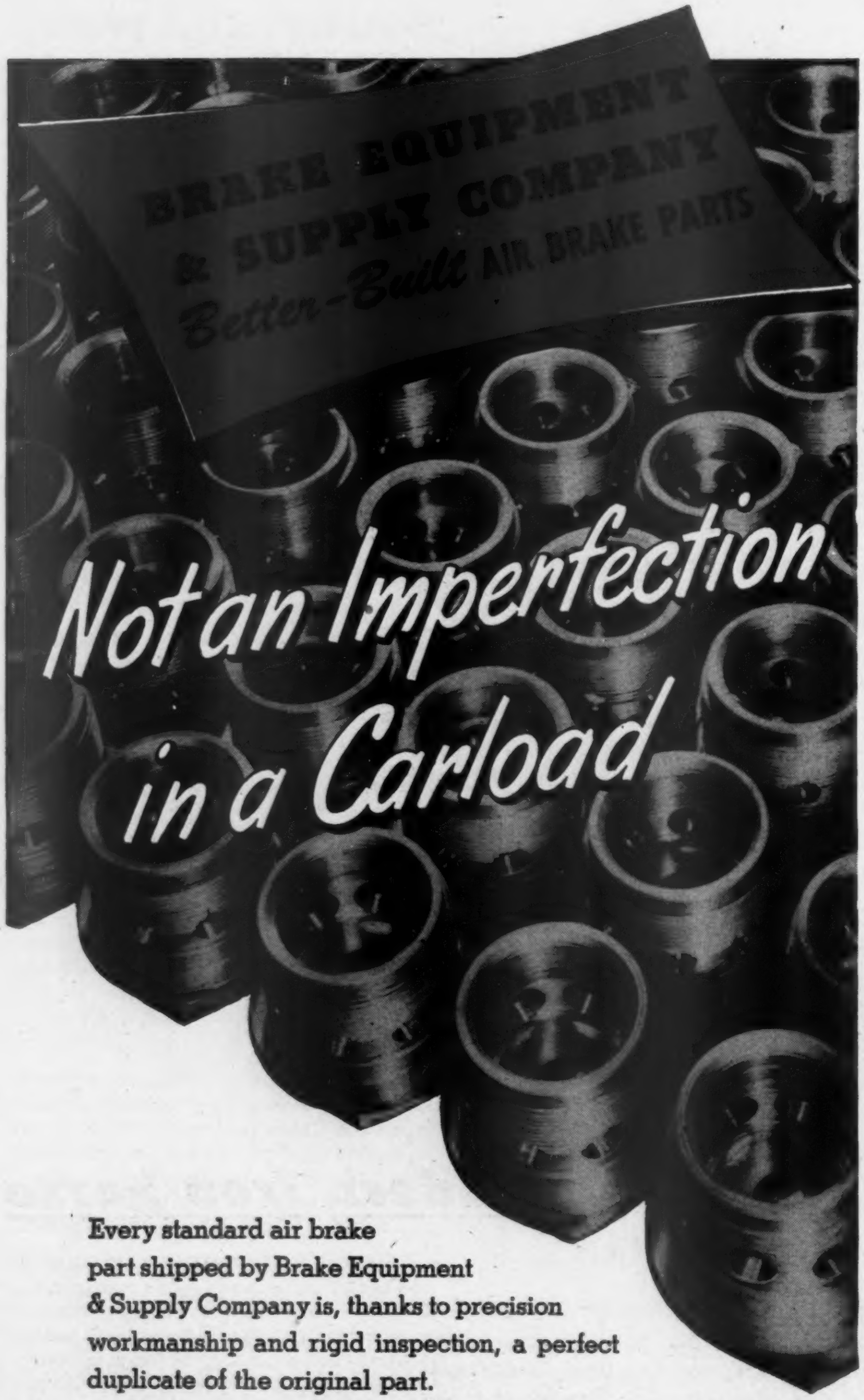
GIVE MORE WORK

—— *to the modern iron horse*

Modern steam locomotives are more efficient to operate than older power because they have the capacity to keep heavy loads rolling . . . at high speeds. Yet locomotives are often seen lying idle in the yards . . . because schedules have not been streamlined to keep pace with the improvements in the modern steam locomotive.

The true savings of Modern Power cannot be realized until maximum utilization has been achieved. To get maximum returns from the dollars invested in your modern steam locomotives calls for a study of their availability . . . and a streamlined scheduling program that is based on utilizing them as much as possible.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED **INCORPORATED, LIMA, OHIO**



Every standard air brake part shipped by Brake Equipment & Supply Company is, thanks to precision workmanship and rigid inspection, a perfect duplicate of the original part.

Precision is a hobby with us, uncompromising inspection a habit. The result is flawless uniformity—your assurance of perfect interchangeability. BE&S parts are fully guaranteed as to material, workmanship, and quality. Deliveries, both current and future, are prompt and dependable. Phone the nearest PORTER district office for a BE&S representative.

PORTER "Better Built" Equipment
Established 1866

H. K. PORTER COMPANY, Inc.
Pittsburgh 22, Pennsylvania
Brake Equipment & Supply Division
District Offices in Principal Cities

accessories for many manufacturers, has opened his own development laboratory and manufacturing plant, the Bernard Welding Equipment Company, at 741-43 East Seventy-first street, Chicago.

◆

SUPERHEATER COMPANY.—*I. F. Sharp* has been appointed district representative in charge of sales and service for the Superheater Company, with headquarters at Chicago.

◆

RAYBESTOS-MANHATTAN, INC.—*David E. Gow,* formerly branch manager of the Cleveland, Ohio, office of the Asbestos Textile & Packing division of Raybestos-Manhattan, Inc., has been appointed packing sales manager, with headquarters in Manheim, Pa., to succeed *Jack E. Cole,* who has been appointed Chicago branch manager of the equipment sales division.

◆

AUTOMATIC ELECTRIC SALES CORPORATION. —*Howard N. Inwood,* member of the equipment engineering staff of the Automatic Electric Company, has been appointed manager of railroad sales of the Automatic Electric Sales Corporation, with headquarters in Chicago. This appointment is coincident with the company's plans for expansion of activity in the railroad field, which include the setting up of special facilities for the manufacture of railroad communication apparatus. In his new capacity, Mr. Inwood will assume charge of all promotional activities relating to the communication and signal departments of railroad organizations.

H. Inwood was born on June 5, 1910, at Elkhart, Ind., and attended Crane College, in Chicago, from 1928 to 1930, and

H. N. Inwood

the University of Illinois, of which he is a graduate electrical engineer, from 1930 to 1933. He entered the services of the Automatic Electric Sales Corporation, as a sales engineer in 1933, remaining with that company until 1934. In 1935 he was employed as a mechanical and electrical engineer in the signal department of the New York Central, and from 1936 to 1937 he was a sales and design engineer with the Ryerson Steel Company in Chicago. In 1937 Mr. Inwood became a mechanical and electrical engineer in the signal department of the Michigan Central, and from 1938 until 1939, he was a mechanical and electrical engineer on quality standards

Roller-Bearing
JOURNAL BOXES
for Railroads

FRANKLIN RAILWAY SUPPLY COMPANY, INC. announces the establishment of a department for the manufacture of Journal Boxes for any make of roller bearings used on railroads. ***We invite your inquiries.***

Franklin Journal Boxes are made to meet A.A.R. requirements and in strict accordance with the tolerances established by all bearing manufacturers.

Franklin enjoys the unique position of being able to manufacture precision-machined Journal Boxes complete from raw material to the finished box entirely within one plant.

Franklin Boxes are made of electric-furnace steel cast in our own foundry or from weldments fabricated in our modern weld shop, at the customer's preference and as the design permits.

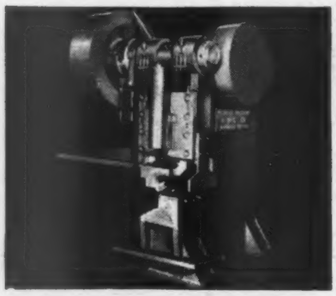
Franklin's modern machine-tool equipment plus trained personnel accustomed to close-tolerance work insure the high degree of precision required for Roller-Bearing Journal Boxes.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
AUTOMATIC FIRE DOORS • DRIVING BOX LUBRICATORS • STEAM GRATE SHAKERS • FLEXIBLE JOINTS • CAR CONNECTION

BEATTY Hydraulic Vertical Bulldozer for heavy forming and pressing.



BEATTY Single End Bar Shear available in capacities up to 300 ton.

BEATTY No. 14 Toggle Beam Punch for structural steel fabrication.

BEATTY 250-Ton Gap Type Press for forming, bending, flanging, pressing.

Beatty engineers have designed and built such a wide range of heavy metal working machines that often, with only a minor change, one of these units can be adapted to solve a *special* problem. When this is done, you get what amounts to a *special* unit, the solution to a *special* problem, for approximately the cost of a *standard* machine. Whenever you have a heavy metal working problem, it pays to come to BEATTY. There is usually a *better way* to handle any fabricating problem. Our engineers are well qualified to help you find that *better way.*

HYDRAULIC HEAVY METAL WORKING EQUIPMENT

BEATTY MACHINE AND MFG. COMPANY HAMMOND, INDIANA

with the Western Electric Company. Mr. Inwood returned to the Automatic Electric Company in 1939 as an electrical design engineer.

◆

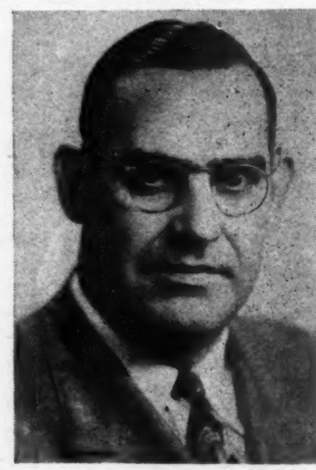
Corley Company.—*Ralph A. Corley, Jr.* and *Robert N. Corley* will carry on the business of their father, Ralph A. Corley, the late president of the Corley Company.

◆

Alemite Division, Stewart-Warner Corporation.—*Gustave Treffeisen* has been appointed sales manager of the Alemite distribution division of Stewart-Warner Corporation, succeeding *Charles I. Kraus,* who has become Alemite distributor at Minneapolis, Minn.

◆

Bowser, Inc.—*John S. Dimon* has been appointed special railway representative for the southeast division of Bowser, Inc., with

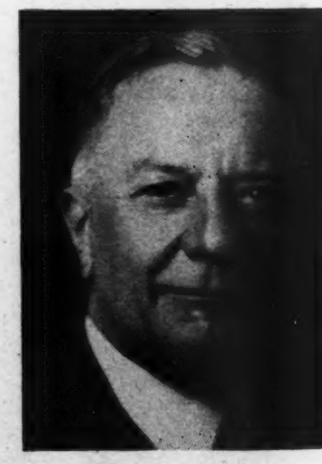


John S. Dimon

headquarters in Washington, D. C. Mr. Dimon was formerly industrial sales manager for the Pennsylvania Salt Company.

Obituary

Safford Kinkead Colby, vice-president in charge of research and advertising of the Aluminum Company of America, died



Safford Kinkead Colby

on August 4, in Pittsburgh, Pa. Mr. Colby was born at Vallejo, Calif., in 1873. In 1895 he joined the Pittsburgh Reduction

Performance Record of General Motors Passenger Locomotive Units on the Atlantic Coast Line.

Locomotive Unit	Miles Operated	Miles Assigned	Average Miles Operated Per Month	Per cent Availability
500	1,494,042	1,589,245	17,173	94.0
501	1,412,304	1,534,403	16,233	92.0
502	1,353,747	1,385,004	17,813	97.7
503	1,265,456	1,309,246	16,651	96.7
504	1,296,429	1,353,725	17,058	95.8
505	1,419,952	1,458,363	18,933	97.4
506	1,304,550	1,330,638	17,394	98.0
507	1,224,418	1,277,149	16,326	95.9
508	1,386,820	1,480,233	18,491	93.7
509	1,229,765	1,319,619	16,397	93.2
510	1,223,933	1,270,271	16,540	96.4
511	1,287,291	1,366,515	17,396	94.2
512	1,309,269	1,385,195	17,693	94.5
513	1,220,818	1,355,514	16,498	90.1
514	1,244,106	1,293,990	16,812	96.1
515	1,177,420	1,240,425	16,129	94.9
516	967,577	1,019,800	14,886	94.9
517	972,543	1,065,087	14,962	91.3
518	921,058	963,885	14,392	95.6
519	944,252	1,003,214	14,988	94.1
520	1,029,287	1,100,106	16,338	93.6
521	874,127	923,166	13,875	94.7
522	890,752	927,222	14,139	96.1
523	885,720	974,902	14,059	90.9
524	339,094	390,830	14,743	86.8
525	369,155	385,215	16,050	95.8
526	354,761	373,293	15,424	95.0
527	359,640	386,096	15,637	93.1
528	340,623	365,328	14,810	93.2
529	331,217	335,667	16,561	98.7
530	289,261	302,071	16,070	95.8
531	297,005	311,254	16,500	95.4
532	152,555	155,417	16,951	98.2
533	145,861	151,771	16,207	96.1
534	154,706	157,876	17,190	98.0
535	151,568	154,838	16,841	97.9
536	154,004	157,541	17,112	97.8
537	144,565	146,860	16,063	98.4
750	1,288,474	1,334,293	17,180	96.6
751	1,338,342	1,425,615	18,086	93.9
752	1,136,605	1,268,302	15,360	89.6
753	1,281,909	1,340,054	17,560	95.7
754	1,084,631	1,116,541	16,487	97.1
755	348,706	369,762	15,161	94.3
756	386,481	387,433	16,804	99.8
757	345,833	363,691	15,036	95.1
758	342,196	353,700	14,878	96.7
759	338,395	339,695	16,920	99.6
760	311,227	321,986	15,561	96.7
761	283,183	290,435	15,732	97.5
762	294,841	306,441	16,380	96.2
763	299,746	307,036	16,653	97.6
764	264,827	278,464	14,713	95.1
	41,265,047	43,504,422	16,382 (Av.)	94.9 (Av.)

GENERAL MOTORS LOCOMOTIVES

ELECTRO-MOTIVE DIVISION

GENERAL MOTORS LA GRANGE, ILL.

Magnews

Newsworthy Items for Those Concerned with Industrial Cleaning and Related Problems.

October, 1947

If You Use Steam Guns, Magnus 94K Is Your Best Bet!

Magnus 94K is the most effective cleaner now available for steam guns: First—it's a concentrated *liquid*, easy to make up in solution for the steam gun system without any danger of getting clogging lumps of undissolved chemicals into the coils or nozzles. Second—94K does not tend to form clogging deposits in the system. Third—it is a scientifically balanced, powerful alkaline cleaner which does not harm surfaces being cleaned and which has no unpleasant fumes or odors.

Magnus 94K will give completely satisfactory service when used in any make of steam- or vapor cleaning machine, such as the Hy-Pressure Jenny, Kerrick Kleaner, Circo Cyclone, Ofeldt, Eclipse, Star, etc.

If you are looking for fast "cutting action" from your steam guns, plus materially improved working conditions, give 94K a thorough trial. Magnus Chemical Co., 77 South Ave., Garwood, N. J. In Canada—Magnus Chemicals, Ltd., 4040 Rue Masson, Montreal 36, Que.

Wherever You Burn Heavy Fuel Oil, Sludge Is a Needless Trouble

Clogged screens, erratic valves, carbonized nozzles and all the other troubles that come from accumulations of sludge in the storage system can be completely eliminated by Magnus Clerex. Even when your oil lines look worse than the example shown below, one pint of Clerex to each 400 gallons of oil in the storage tank will disperse existing sludge in burnable condition throughout the body of the oil. And when the tank is clear, you can keep sludge from forming by using one pint of Clerex to each 1000 gallons of fresh oil pumped into the tank.

NEW CLEANING IDEAS

For Further Details Write Magnus

For Most Effective and Speedy Cleaning of Diesel Parts—the combination of Magnus 755, emulsion solvent carbon remover, and the Magnus Aja-Dip Cleaning Machine cannot be equalled. Where hand methods and ordinary solvent could produce eight heads in 30 hours, the Magnus method delivers eight heads in four hours, better cleaned without "elbow grease." No. 121

•

For that Routine Job of Cleaning Air Filters—the fast way and the sure way is to use Magnusol. You mix one part of this concentrated cleaner with eight parts kerosene or safety solvent and soak the filters in this solution. Then drain and flush clean with water or with a steam gun. No. 122

•

Good Medicine for Your Shop Tractors—are the Magnus Cleaners and Cleaning Methods outlined in the special Magnus Cleaning Manual on automotive equipment. Ask for a copy of the "Truck and Bus Cleaning Manual." No. 123

•

You Can Use a Sure-Fire Penetrating Oil in a great many places in your shops. Magnus Metaffin (in wide use in the automotive field for the control of sludge in lube oil) has demonstrated exceptional abilities as a penetrating oil. A mighty effective cure for sticking valves, too. No. 124

WITH RAILROADS IT'S MAGNUS

CLEANERS • EQUIPMENT • METHODS

Company (which became the Aluminum Company of America in 1907) as assistant manager of its New York office, and later was appointed manager. In 1905 he was placed in charge of the company's Pacific coast representatives and in 1913 returned to the east, where two years later he became assistant general sales manager, with headquarters in New York. He was elected president of the American Magnesium Corporation in 1920 and president of the American Body Company in 1925. The latter was a manufacturing subsidiary of the Aluminum Company at Buffalo, N. Y. In 1928, Mr. Colby was placed in charge of the sales promotion and advertising divisions at Pittsburgh. He became a vice-president of the Aluminum Company in 1931 and, in 1937, the supervision of the aluminum research laboratories was added to his duties.

◆

HOWARD J. SNOWDEN, a member of the sales staff of the Baldwin Locomotive Works, died on August 22.

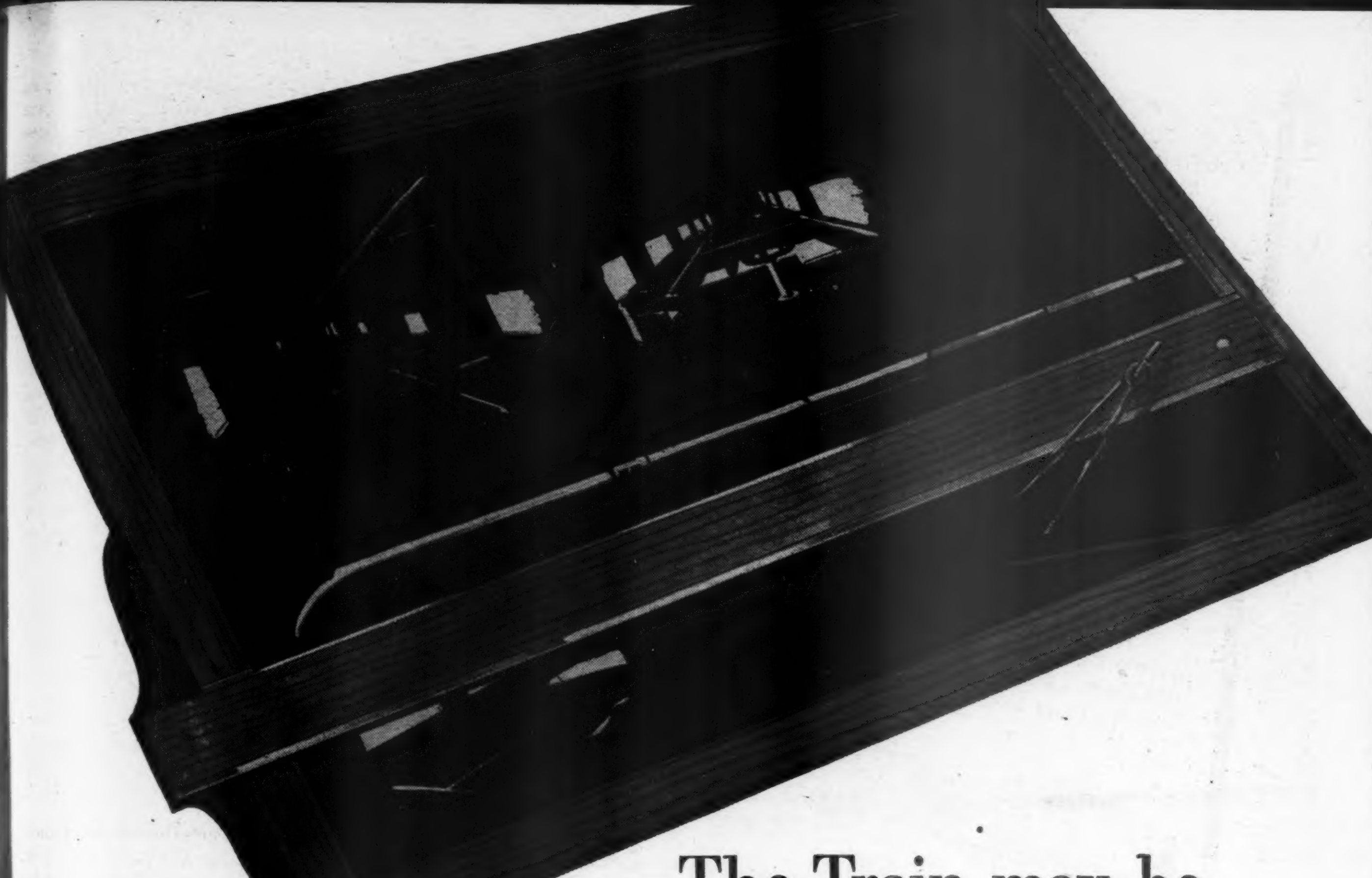
Personal Mention

General

ALVIN R. RUITER, superintendent of motive power of the Chicago, Rock Island & Pacific, with headquarters at Chicago, has retired. Mr. Ruiter was born on June 26, 1880, at Dumont, Iowa, and attended school in Marshalltown, Iowa. He entered railroad service in 1897 with the Iowa Central as a machinist apprentice. In 1901 he became machinist on the Chicago Great Western at Oelwein, Iowa; in 1903 a machinist on the Illinois Central at Waterloo, Iowa, and later machinist and enginehouse foreman on the Chicago, Milwaukee, St. Paul & Pacific, at Dubuque, Iowa, and Perry, respectively. He entered the employ of the Rock Island in 1905, and subsequently served as enginehouse foreman, general foreman and master mechanic. He was master mechanic at various points on the railroad for 21 years; in 1938 was appointed assistant to chief operating officer, and on July 1, 1940, superintendent of motive power.

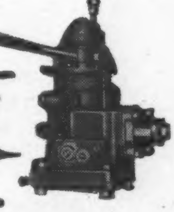
E. K. BLOSS, supervisor of Diesel maintenance and operation of the Boston & Maine, with headquarters at Boston, Mass., has been appointed mechanical engineer of the B. & M., the Main Central and the Portland Terminal, reporting to the general manager. The position of supervisor of Diesel maintenance and operation has been abolished.

M. R. WILSON, master mechanic of the Chicago, Rock Island & Pacific, at Chicago, has been appointed superintendent of motive power, with headquarters at Chicago. Mr. Wilson was born at St. Joseph, Mo., on June 17, 1898. He entered railroad service in 1914 as a machinist apprentice in the employ of the Wabash at Decatur, Ill. From 1918 to 1922 he was a machinist with the Missouri-Kansas-Texas, the St. Louis-San Francisco, and the New York Central. After a short period as master mechanic for a lumber company, Mr. Wilson entered the service of the Rock Island



The Train may be still on the Drawing Board

but the Brakes for it are HERE



There are many new trains in the planning stage, and a lot of searching for new appeals and advantages that will add to safety and luxury, and win and hold passenger patronage.

One essential with years of planning behind it—the "*HSC*" *Electro-pneumatic Brake* —provides a solid base on which passenger appeal can be built. It is completely modern, provides the instant, positive response that safeguards passenger comfort and safety, and has proved its superior qualities in years of service on the nation's most famous trains.

If you have any new passenger trains in mind, equip them with this modern combination:

HSC Air Brakes . . . for braking flexibility to match modern train speeds, and unequalled smooth action. Speed Governor Control . . . for regulating brake forces to wheel speeds. *AP Decelostat* . . . for wheel slip detection to keep the wheels rolling.

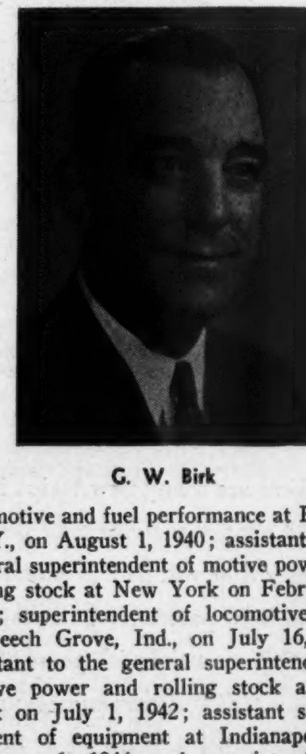
Westinghouse Air Brake Co.

W I L M E R D I N G , P A .

in 1924, and served until 1929 as assistant foreman, erecting foreman, and enginehouse foreman, at Cedar Rapids, Iowa. From 1929 to 1942 he was enginehouse foreman and general foreman at various points on the Rock Island. In 1942 he was appointed master mechanic at Chicago.

WALTER BOHNSTENGEL, engineer of tests of the Atchison, Topeka & Santa Fe at Topeka, Kan., has retired after 36 years of service.

G. W. BIRK, superintendent of equipment of the Big Four district of the New York Central System, at Indianapolis, Ind., has been appointed assistant general manager of the Big Four district with headquarters at Indianapolis, Ind. Mr. Birk was born at Indianapolis on April 19, 1900. He is a graduate of Purdue University (1925) with the degree of B. S. in mechanical engineering. He entered the service of the Cleveland, Cincinnati, Chicago & St. Louis (part of the N. Y. C. System) in 1918, and served as apprentice, special apprentice, and special engineer at Indianapolis until 1930, when he became assistant air-brake supervisor. On February 16, 1936, he was appointed special inspector; on October 1, 1937, lubrication inspector; supervisor of



G. W. Birk

locomotive and fuel performance at Buffalo, N. Y., on August 1, 1940; assistant to the general superintendent of motive power and rolling stock at New York on February 1, 1941; superintendent of locomotive shops at Beech Grove, Ind., on July 16, 1941; assistant to the general superintendent of motive power and rolling stock at New York on July 1, 1942; assistant superintendent of equipment at Indianapolis on February 1, 1944, and superintendent of equipment on January 1, 1946.

P. C. DUNN, assistant supervisor of Diesel maintenance and operation of the Boston & Maine, has been appointed assistant general superintendent motive power of the Boston & Maine, the Maine Central, and the Portland Terminal, with headquarters at Boston. Mr. Dunn, who will report to the general superintendent motive power, will have complete jurisdiction over all Diesel motive power. The position of assistant supervisor of Diesel maintenance and operation has been abolished. Mr. Dunn was born on April 26, 1910, at Boston. He received his A.B. degree from Dartmouth College in 1932 and his M.S. from the

Spicer

announces the Models 6 and 6-I

POSITIVE GENERATOR DRIVES

now being furnished for the new railway cars

● The Models 6 and 6-I Spicer Generator Drives incorporate new developments, to still further increase the excellent performance records made by more than 4000 Drives on over 40 railroads in the United States and Canada.

WRITE FOR DESCRIPTIVE BULLETIN

43 YEARS OF Spicer SERVICE

SPICER MANUFACTURING

Division of Dana Corporation

TOLEDO 1, OHIO

Massachusetts Institute of Technology in 1941. He entered the service of the Boston & Maine in January, 1935, as a special apprentice after spending summer seasons from 1930 to 1935 with the Mt. Washington cog railway as fireman, engineman, mechanic and finally as assistant to president in charge of operations. On comple-

Paul C. Dunn

tion of his apprenticeship in 1939, Mr. Dunn became traveling mechanical inspector at Boston. From June, 1940, to June, 1941, while on a leave of absence he studied business and engineering administration at Massachusetts Institute of Technology on an Alfred P. Sloan fellowship. In July, 1941, he was appointed enginehouse foreman at Dover, N. H.; in February, 1942, he became general foreman at East Deerfield, Mass.; and in December, 1942, manager of the suggestion system, with headquarters at Boston. In March, 1944, he entered the United States Army as captain in the 752nd Railway Operating Battalion, serving in France, Belgium, Holland and Germany, leaving the Army in January, 1946, as battalion commander of the 764th Railway Shop Battalion, with the rank of major. On return to the Boston & Maine, Mr. Dunn was appointed assistant supervisor Diesel maintenance and operation.

Edgar B. Fields, assistant engineer of tests of the Atchison, Topeka & Santa Fe at Topeka, Kan., has been appointed engineer of tests, with headquarters at Topeka.

E. V. Myers, superintendent of motive power of the St. Louis Southwestern of Texas, at Tyler, Tex., has had his jurisdiction extended over the lines of the St. Louis Southwestern, with an office also at Pine Bluff, Ark.

J. H. Saltzgaber, assistant superintendent of equipment of the Cleveland, Cincinnati, Chicago & St. Louis at Indianapolis, Ind., has been appointed superintendent of equipment, with headquarters at Indianapolis.

J. E. Brown, superintendent of motive power of the St. Louis, Southwestern at Pine Bluff, Ark., retired on July 31.

Orlin H. Clark, whose appointment as superintendent of the car department, Missouri Pacific, with headquarters at St Louis, Mo., was reported in the August

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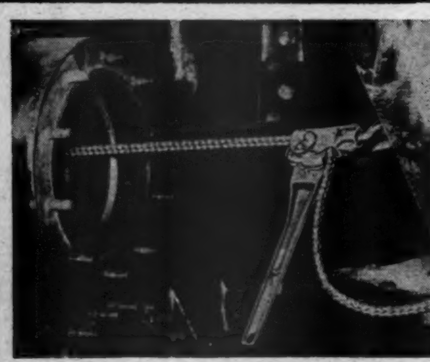

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issue was born on July 22, 1897, at Borden, Ind. He began his railroad career in 1914 with the Louisville & Nashville as a carman helper at Louisville, Ky., and sub-

Orlin H. Clark

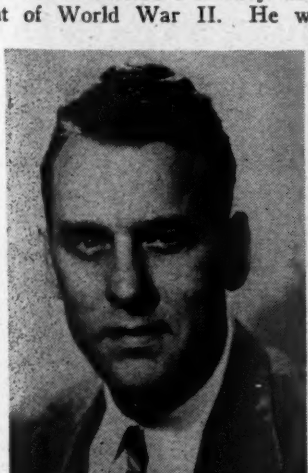
sequently held various positions on that road. In 1924 he entered the employ of the Missouri Pacific as assistant general car inspector at St. Louis. In 1926 he became supervisor of car repair bills at Houston, Tex., where he became general car inspector in 1939. He returned to St. Louis in 1942 as assistant superintendent of car department.

S. T. Kuhn, master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis at Chicago, has been appointed assistant superintendent of equipment, with headquarters at Indianapolis, Ind.

Diesel

Aubrey M. Cary, general foreman of the Southern at Winston-Salem, N. C., has been appointed general Diesel supervisor at Spencer, N. C.

Peter J. Sasgen has been appointed general supervisor of Diesels of the Seaboard Air Line, with headquarters at Jacksonville, Fla. Mr. Sasgen received part of his early training in the United States Navy. He re-entered the Navy with the advent of World War II. He was in



Peter J. Sasgen

submarine service and was awarded the Silver Star. After the close of the war he became associated with the Electro-Motive

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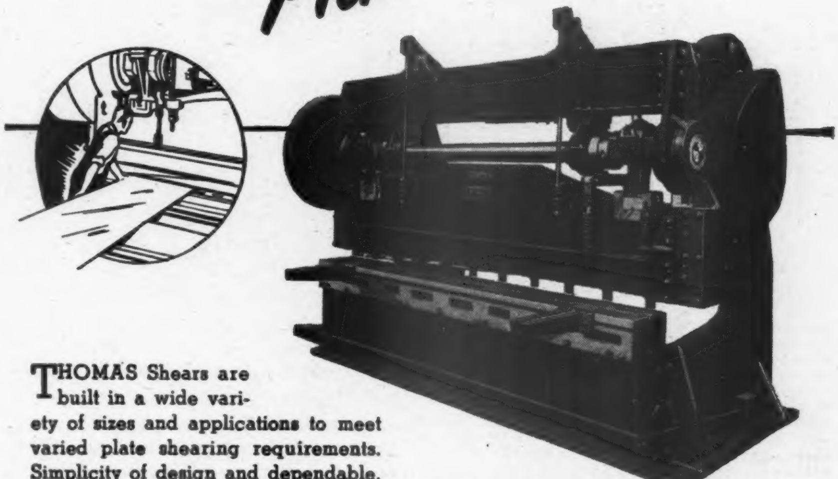

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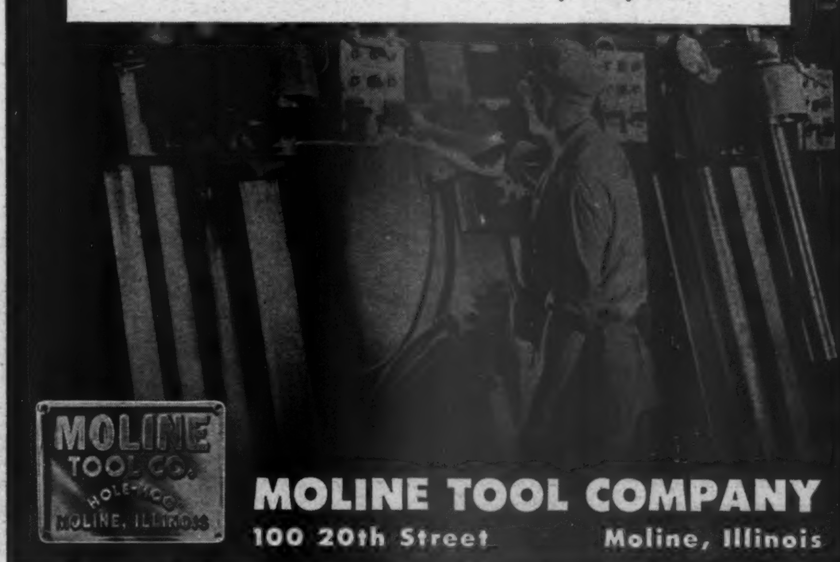

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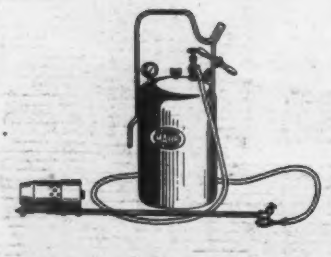
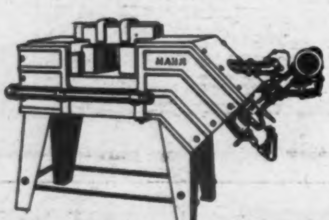


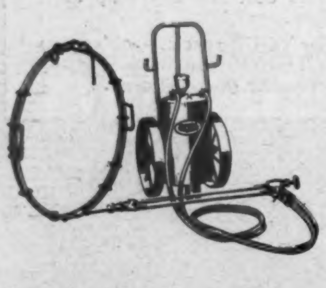
MAHR NO. 105 KEROSENE TORCH

Burning either kerosene or light distillate, this torch may be used for thawing frozen switches, for weed burning, for preheating before bending, welding, forming or straightening, for cupola lighting, for drying, and many other purposes. Provides a quick, intense, concentrated heat. Lights quickly. Burns efficiently and smoothly. Torch is self-contained. Has air pump in tank to supply its own pressure. Weighs only 45 pounds so is easily moved from place to place. MAHR automatic shut-off valve shuts off oil flow if fuel line break occurs. Burns about 1 gallon of fuel per hour. Has 5 gallon tank. Also available in larger 15 gallon model.



MAHR NO. 39 FLUE WELDING FORGE

With capacity of from 40 to 60 tubes per hour, this MAHR forge is ideal for welding good ends on boiler tubes. Forge has adjustable "back stop" so that different lengths of the tube end may be heated. Forge is adaptable to any of the standard size flues. Ruggedly constructed of high strength cast sections, thoroughly reinforced. May be either gas or oil fired. Uses low pressure air for combustion. Air curtain is provided.



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Division of General Motors Corporation, from which company he resigned to enter the service of the Seaboard Air Line.

Master Mechanics and Road Foremen

John W. Raynes has been appointed road foreman of engines of the Southern with headquarters at Appalachia, Va.

J. H. Burger, master mechanic of the Illinois Central at Champaign, Ill., has been transferred to the position of master mechanic at Vicksburg, Miss.

John Leprich has been appointed road foreman of engines of the Baltimore & Ohio, with headquarters at Washington, Ind.

J. W. Martin, master mechanic of the Illinois Central at Vicksburg, Miss., has been transferred to the position of master mechanic at Jackson, Tenn.

Thomas L. Stewart has been appointed assistant master mechanic of the Southern at Knoxville, Tenn.

W. L. Jones, master mechanic of the Illinois Central at Jackson, Tenn., has been transferred to the position of master mechanic at Champaign, Ill.

Electrical

J. A. Andreucetti, who has retired as chief electrical engineer of the Chicago & North Western, at Chicago, was born at Chicago on May 1, 1881. He entered the service of the North Western in 1905 as an electrician's helper, and from 1908 to 1916 served successively as electrician, acting foreman and foreman on electrical construction, and general foreman. In September, 1916, he was appointed assistant electrical engineer; in May, 1927, electrical engineer; and in 1944 chief electrical engineer.

Car Department

S. Fesus has been appointed general car foreman of the Chicago & North Western at Chicago.

Richard Reed, general car foreman of the Chicago & North Western at Clinton, Iowa, has retired.

O. P. Jones has been appointed electrical engineer of the Chicago & North Western at Chicago.

E. J. Cheverette has been appointed general car foreman of the Chicago & North Western at Clinton, Iowa.

A. Calhoun Malone has been appointed foreman car repairs of the Southern at Greenville, S. C.

W. L. Pratt has been appointed general car foreman of the Chicago & North Western at Chicago.

Ernest L. Koon has been appointed foreman coach repairs of the Southern at Columbia, S. C.

E. F. Iverson has been appointed general car foreman Chicago & North Western at Council Bluffs, Iowa.

George R. Maloney has been appointed chief interchange inspector of the Peoria

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